# Industry and Power

## June 1954


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for engineers and executives responsible for

**— engineered plant facilities**

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VOLUME 66 **June 1954** NUMBER 6

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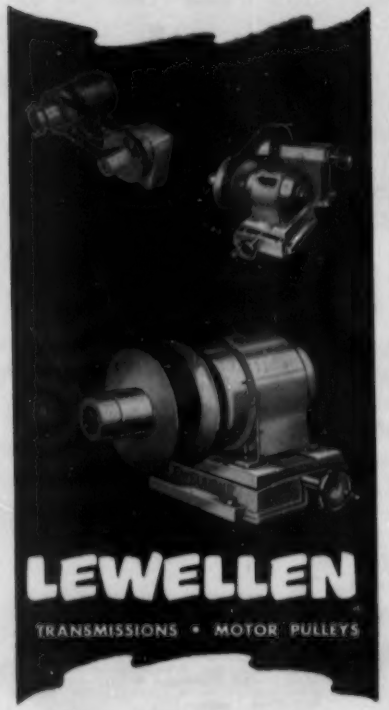

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# acorns

**. . . recently announced . . . worth watching**

### No More Gaskets

• A simple inexpensive means has been devised at the Naval Research Laboratory for assembling high-pressure, high-temperature A.S.T.M. type 304 stainless steel piping without gaskets. Ease of assembly and dis-assembly and freedom from contamination or corroding materials are additional advantages for the principle, which is believed to be capable of extension to materials other than stainless steel.

### Radioactive Activities

• Radioactive materials will soon be used by the Caterpillar Tractor Co. to accelerate longtime endurance tests on parts and to provide data not obtainable by conventional methods. Engineers will be able to study piston ring wear, for example, by running a radioactive ring in the engine, then measuring radioactivity in the crankcase oil.

### Stronger Than Steel

• A plastic stronger than steel is being made from a polyester resin reinforced with glass fibers. It may be used in the construction of chemical tanks and other equipment subject to corrosion, since it can stand continuous temperatures of 300 F and intermittent temperatures as high as 480 F.

### Lighter-Weight Transformers

• A new design for scrapless laminations used in shell-type transformer cores makes possible transformers that are lighter in weight than those made with conventional scrapless laminations. The new design is not expected to replace older designs but rather to supplement them, particularly in high-voltage applications. The laminations can be readily punched from sheets or rolls of magnetic steel without any scrap material leftovers.

### "Hot" Waste Disposal

• Research on radioactive waste disposal indicates that today's sewage disposal plant may play an important role in disposing of radioactive wastes from future atomic industries. The experimental work is concerned with biological concentration of radioactive materials into sewage sludge that can be dried and burned so that only a small amount of "hot" residue must be stored or otherwise disposed of.

### Perfect Crystals

• Perfect crystals of pure iron, 100 times stronger than any known metallic crystal and resistant to rust, have been developed at the General Electric Co. research laboratory. These crystals are said to represent the first production of metals that are as strong as theory predicts they should be. Although no immediate use for them is known as yet, G. E. researchers expect that science will come up with new applications.

### Ultra-High Temperatures

• The atomic age has forced intensive research for new materials to control ultra-high temperatures, it was recently stated by a leading industrial scientist.

This scientist has predicted that new materials for heat resistance will play a significant role in the development and expansion of American industry. He foresees the development of refractories that will perhaps handle temperatures as high as 7200 F, which is higher than the melting point of tungsten, and considerably higher than the heat generated in rocket engines. Today, the ceramic industry is able to cope with temperature only up to about 5,400 F at the maximum.

### Britain's Atomic Factories

• An official report recently released by the British government analyzes the overall approach in organizing atomic factories; processes used in building these plants, including their design and construction history; considers special health problems that arose; outlines future plans for nuclear energy projects.

### Promising Substitute

• The Naval Ordnance Laboratory has announced the development of Thermenol, a high temperature alloy of non-critical metals, showing promise as a substitute for certain stainless steels in many applications. Thermenol is 20-25 percent lighter than stainless steel and its physical characteristics include a high tensile strength coupled with a high resistance to corrosion or oxidation.

# Air Casualties

***It's bad air that does it. But you can step up production by putting a Coppus Blower on the job to keep the air moving — and keep the men cool.***

The kind of air a man works in has a lot to do with how much work he can turn out.

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Portable and adaptable for special purposes, Coppus Blowers and Exhausters will have dozens of uses around your plant. The "Blue Ribbon" (a blue painted band) is your assurance of quality performance at lowest cost.

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THE BLOWERS THAT PUT MORE MINUTES IN EVERY MAN-HOUR

**CABLE MANHOLE AND TANK VENTILATORS — BOILER MANHOLE BLOWERS AND EXHAUSTERS — HEAT KILLERS — SHIPHOLD VENTILATORS . . . DESIGNED FOR YOUR INDUSTRY — ENGINEERED FOR YOU**

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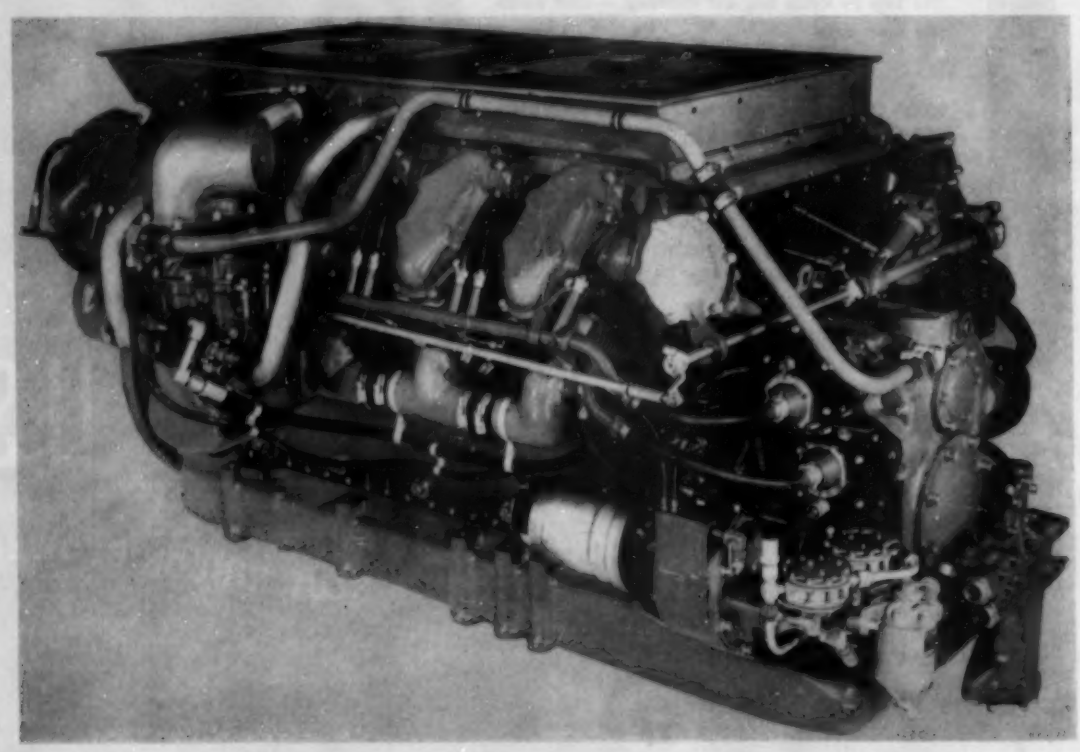
# New Army Air-Cooled Engine Now Available to Industry



**Continental Motors Corporation's 810 h.p. air-cooled engine pictured above, built for U. S. Army's famed General Patton tank, is one of a wide range of engines now available for heavy-duty commercial and industrial uses . . . The electrical wiring ignition harness, manufactured by National Electric, is a high voltage, radio-shielded system — rugged enough for combat — resistant to extremes of heat and cold — designed and built to operate under the most adverse conditions . . . National Electric also makes fine quality production harnesses for peacetime uses such as Automatic Clothes Washers, Dryers, Dishwashers and other home appliances . . . whatever your product—National Electric offers you more than a quarter century of experience in designing and producing fine electrical harnesses.**

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*High voltage ignition harnesses*
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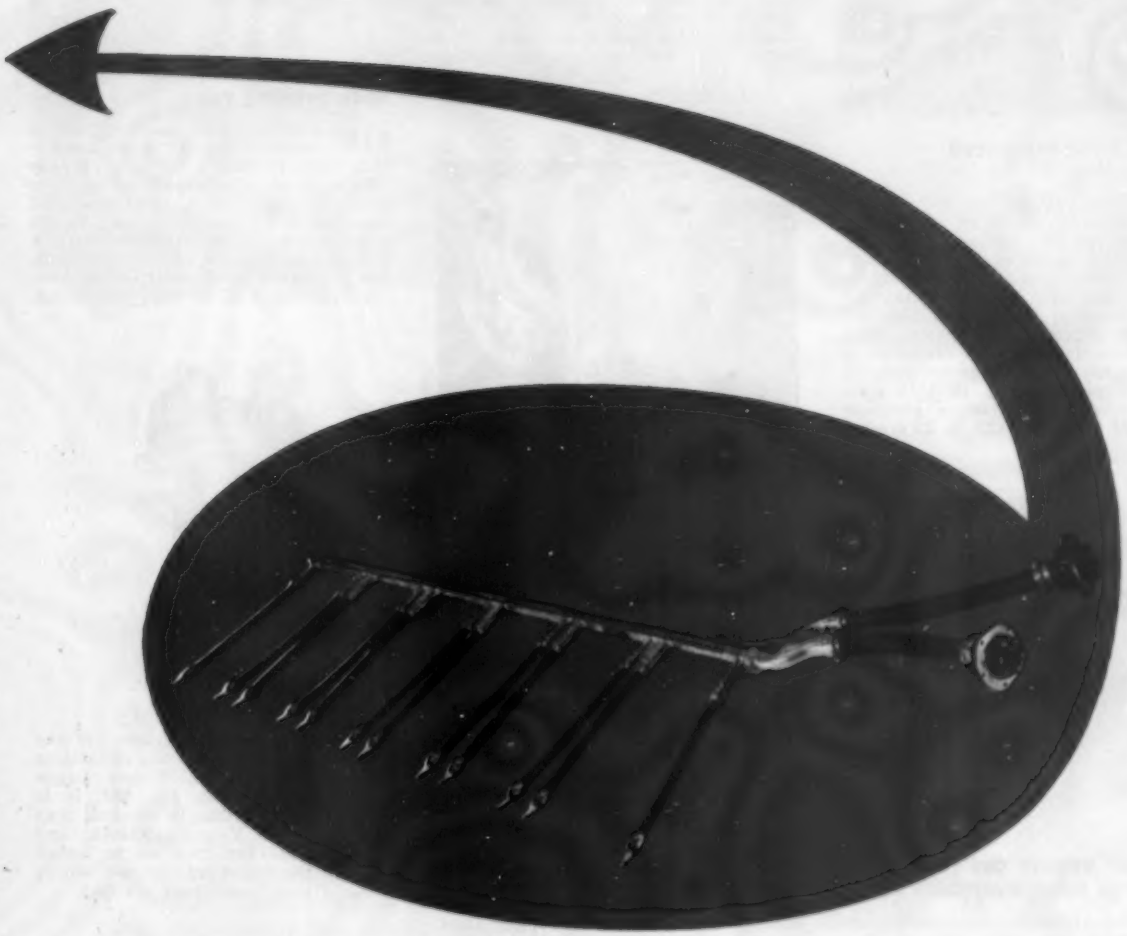
*Home appliance wiring harnesses*
*Jet engine ignition harnesses*
*Switchboard panels*
*Control panels*
*Electrical timing mechanisms*
*Electrical temperature indicators*
*Automatic relay and switching devices*

*Electro-mechanical assemblies — manufactured to customers specifications*



# Niles, Michigan

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# new equipment

. . . new developments

### Filters have increased service life

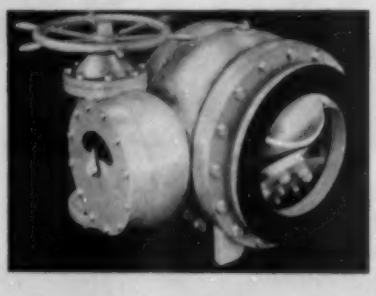
**F10** New designs on the smaller units of Flo-Klean filters have increased service life and improved performance according to Cuno Engineering Corp. The backwash nozzle with hydraulically balanced discharge reduces bearing and motor loads, and adjustable shoes improve performance while removing a wide variety of foreign matter from large volumes of liquids. Capacity is up to 1275 gpm with a range of degree of filtration from .0025 to .030 in. (230 to 25 mesh).

### Industrial engine designed with large bore, overhead valve

**F11** The greatest concentration of power per cubic inch of displacement in its weight and size class is available in this 172 cu in., four-cylinder industrial engine, according to the manufacturer, Ford Div. of Ford Motor Co. It develops 61 brake hp at 2800 rpm. The large 3.90 in. bore is combined with a short 3.60 in. stroke to cut piston travel, friction, and fuel costs. Ignition and distributor are sealed against moisture and dust. The engine has a full-flow oil filter with full-pressure lubrication.

### Rust preventative protects lubricating systems

**F12** Rust preventative, Gulf Oilcoat T, developed by the Gulf Oil Corp. is especially applicable for protection of machinery during shipment, storage, or seasonal shut-downs. It is compatible with machine lubricating oils and can be applied by spraying, dipping, or brush.

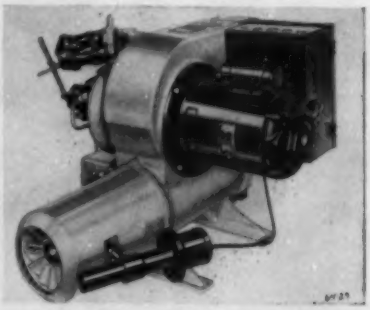


### Ball valves free from vibration

**F13** For water works, municipal, power plant, and a broad range of industrial applications, S. Morgan Smith Co. introduces its Smith Ball Valves, manual type. Designed for 150 psi working pressures with 125 psi, ASA flanges (C. I.), the valve features ease and tightness of closure, multiplication of leverage, and freedom from vibration.

### Roller bearings in rugged steel housing

**F14** Heavy duty roller bearings, especially designed for severe operating conditions, have been added to the line of Link-Belt Co. They incorporate precision self-aligning roller bearings in a particularly rugged steel pillow block housing and can be lubricated with either oil or grease. Known as Series LPK6800F, they are made in shaft sizes from 2 7/16 to 6 11/16 in. in diameter. Additional information, including dimensions and load ratings, is available in a booklet.



### Burners adaptable to wide heating range

**F15** The "4" Hev-E-Oil burner is designed for use where a burner is used to heat a building of over 1500 sq ft of radiation, or where more than 6000 gal of oil or 45 tons of coal per year is burned. According to the manufacturer, Cleaver-Brooks Co., it is the only modern, all electric ignition oil burner designed to burn low-cost No. 4 or 5 oil without preheating.

### Integral strainer trap takes fewer fittings

**F16** Armstrong Machine Works has added to its line of integral strainer steam traps, a new larger model designated as No. 882. It is said to cost less than a standard trap plus separate Y-type strainer, and fewer fittings are required to install it. It is recommended for use where dirt and scale conditions are bad.

### Vibrating conveyor simplified

**F17** Smaller vibrating conveyors featuring greater simplicity, reduced power requirements, and improved efficiency have been developed

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 34/35 & 98/99.

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CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

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# Not a cent for repair or replacement

## ... of Monel parts in more than 27 years!

**Continuous Performance.** Installed by the Potomac Edison Company in 1927, this Chapman valve has stem, seat and disc rings of long-lasting Monel. Not a single one of these Monel parts has ever given trouble, and the valve itself is still in perfect operating condition.

**Let's *all* take a careful look at this valve.**

It's a 16-inch motor-operated Chapman. You'll find it on the No. 3 unit main steam header at the R. Paul Smith Station of the Potomac Edison Company, in Williamsport, Md.

When it was installed in 1927, no one was sure exactly how long its Monel® stem, Monel seat and Monel disc rings might last.

And no one knows, even *today*. This Chapman valve—now well past the quarter-century mark—is still in operation, still working perfectly. Despite more than 27 years of service at 350 W.S.P. and 700°F., not a single Monel part has ever needed a penny's worth of repair!

Remember this performance next time you need valves. Specify Monel trim and you insure yourself against frequent repair bills and costly maintenance expense.

In Monel, you have a metal that is stronger than structural steel, and harder than most non-ferrous metals. This, of course, helps reduce failures caused by overstressing seats, stems and other working parts.

Because of its hardness, Monel can substantially reduce damage caused by turbulence, flow erosion and particle abrasion. Being rustproof and corrosion-resisting, Monel can greatly extend the life of valves operated under severely corrosive conditions. And its good heat-resisting qualities permit the use of Monel in service up to 750°F.

Leading valve manufacturers stock Monel-trimmed valves for all power plant applications. Ask about these valves. They're designed to give you extra long life with a minimum of maintenance. And write us for a helpful booklet that shows how you can save money on valves used for many kinds of difficult service. Just ask for a copy of "Trimming Valve Costs with Lasting Trim."

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67 Wall Street New York 5, N. Y.

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INCO TRADE MARK **NICKEL ALLOYS**

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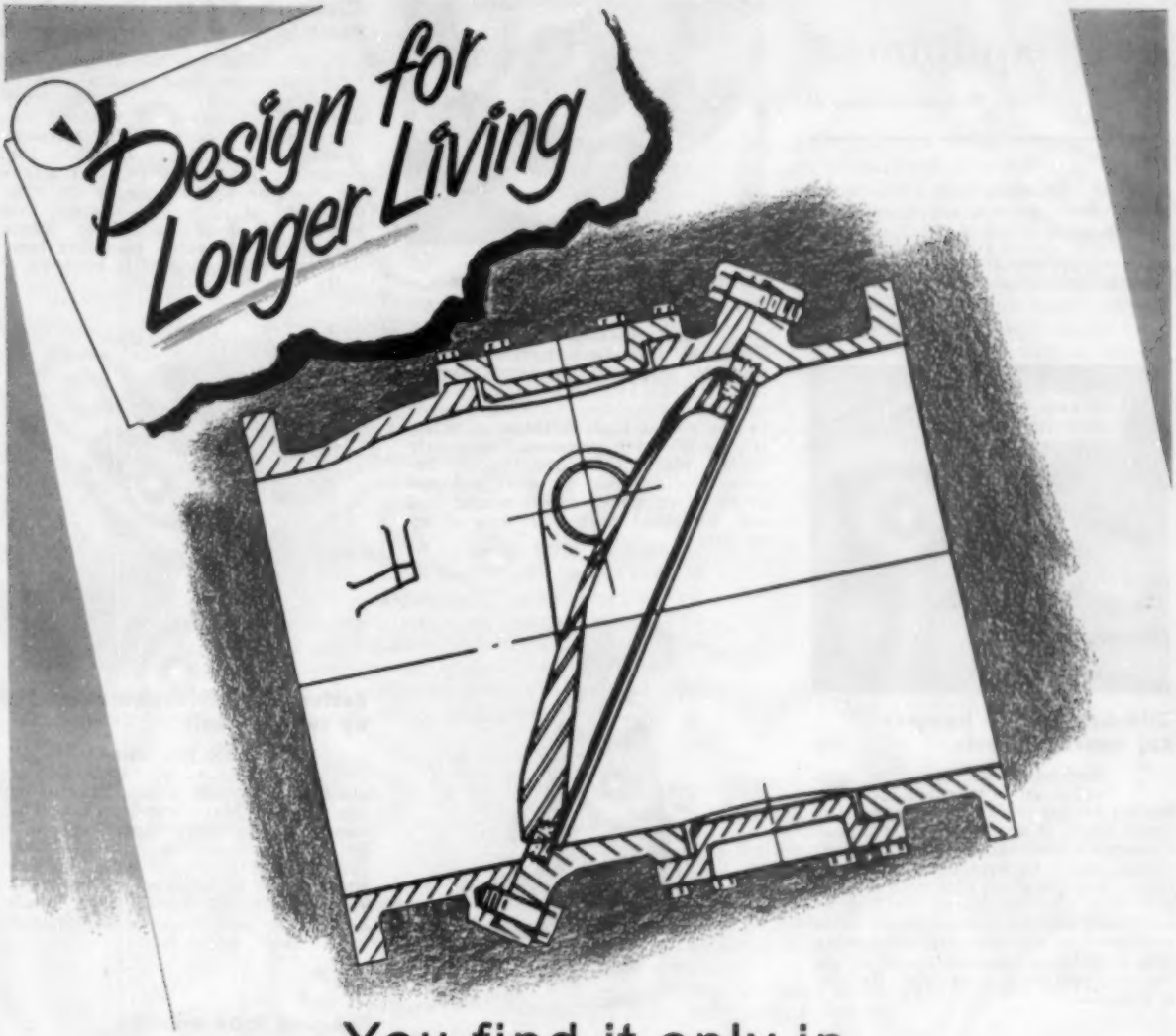


...You find it only in

# CHAPMAN'S
## *Tilting Disc* CHECK VALVE

Here you can see the specially designed *airfoil section* of the disc in the Chapman Tilting Disc Check Valve . . . and you can see how the disc-seat lifts away from the body seat when opening (and drops into contact when closing) with no *sliding or wearing of the seats.*

Under usual piping arrangements this unique designed disc won't slam . . . just cushions itself to a quiet closing that does not even jar the line.

And this balancing is the reason why Chapman Tilting Disc Check Valves greatly reduce head-loss over standard designed swing-type checks . . . as proven by tests in leading engineering schools and by actual performance in the field.

Available in iron or steel. Complete test data is given in Catalog No. 30–write for your copy now.

**The Chapman Valve Mfg. Co.**
INDIAN ORCHARD, MASSACHUSETTS
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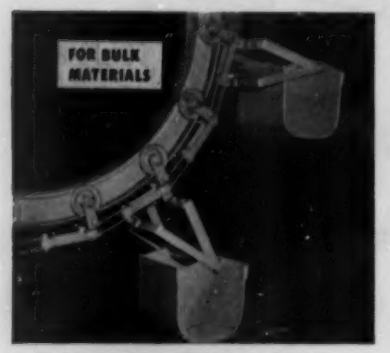
# new equipment

—Starts on page 10

by Hewitt-Robins, Inc. The units, mounted on springs, are designed to convey at a speed of 38 ft per min. Pans with special coating or of stainless steel are available for handling extremely corrosive and abrasive materials.

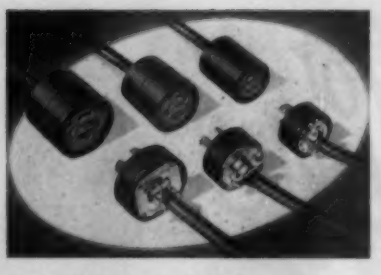



### Stiff-Arm bucket hangers cut conveyor costs

**F18** Multiplane bucket trolley conveyor with a patented Stiff-Arm bucket hanger design, said to result in lower costs, is announced by Hapman Conveyors, Inc. Because bucket hanger design keeps buckets upright, it permits a multiple-plane path with a single conveyor, and eliminates the cost of numerous transfer points. Single drive unit operates the conveyor, eliminating the expense of separate motor drives for each plane of operation. Bulletin is available.

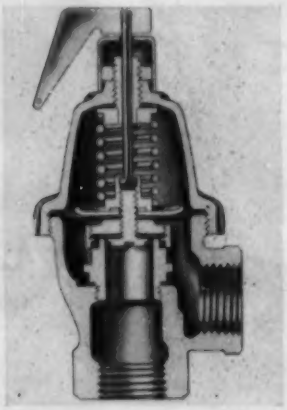
### Circuit Breaker has special trip bar

**F19** Two-pole EQ molded case circuit breaker designed for use in panelboards, load centers, or individual enclosures, has a common tripper bar arrangement as an integral part of the trip mechanism and combines thermal and magnetic tripping for complete protection. Made by Small Air Circuit Breaker Div. I-T-E Circuit Breaker Co., it is available in ratings from 10 to 50 amp; 120/240 v ac; 5000 amp interrupting.



### Receptacles and connectors reduce maintenance costs

**F20** Announcement of a new line of Hart-Lock interlocking receptacles and cord connectors, featuring "NO-TRAK," non-tracking, noncarbonizing molding material, is made by the Arrow-Hart & Hegeman Electric Co. The devices are said to greatly reduce plant maintenance costs because the molding material will not break down under severe arcing and will withstand flash-over tests of up to 5000 v.



### Valve suitable for most water heating installations

**F21** Taco Heaters, Inc. relief valve No. 103 was tested and approved under the ASME code for a discharge capacity of 326,000 Btu at 30 psi, which is said to make it suitable for approximately 80 percent of all hot water heating installations. It features a bronze body and dome, high temperature non-sticking silicone rubber disc, stainless steel spring, nylon reinforced Hycar rubber diaphragm, and renewable bronze seat. Literature is available.

### Solvent resistant packing gives longer service

**F22** Two new mechanical rod packings developed by the Mechanical Packing Div. of the Flexrock Co. use an entirely new lubricant and impregnation process for handling nonwater soluble solvents such as benzene, carbon tetrachloride, and Stoddard solvents. It is said to be less expensive than other packings offered for the same service because it gives better and longer service.

### Cleaner minimizes foam in spray washing machines

**F23** Composition No. 161, an alkaline-type material designed to clean aluminum, steel, and other metals in pressure-spray washing machines without objectionable foaming, is announced by Oakite Products, Inc. Recommended for all pressure washing machine applications in the concentration of ½ to 2 oz per gal, this powder is simply added to warm water, then heated to operating temperature. No boiling-in is required.

### Better air distribution offered by twin-fan unit

**F24** A 250,000 Btu twin-fan model has been added to the line of gas-fired unit heaters manufactured by the Reznor Manufacturing Co. The two fans, operating from a single heavy-duty ¼ hp motor, move 3200 cfm with an air throw of 83 ft. The smaller fans are said to provide more effective air distribution at a much lower noise level than can be obtained with a single larger fan.

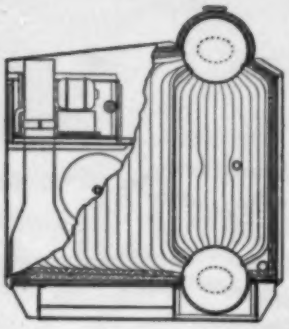
### Labeling tape adheres to oily surfaces

**F25** Pressure-sensitive tape, Oil Stik, adheres perfectly to oily as well as to dry metal surfaces according to the manufacturer, Labelon Tape Co., Inc. Tape has a writing surface suitable for pencil, ink, or crayon, and can be furnished pre-printed with any desired combination of letters, numbers, or symbols.

### Housings for dust removal systems built by user

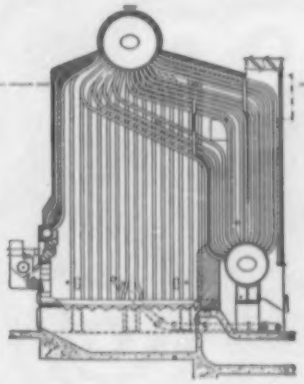
**F26** Liquid precipitating stack gas scrubbers have been developed for installation in low cost housings of cinder block concrete or fabricated

# WHICH C-E BOILER MEETS YOUR STEAM NEEDS BEST?

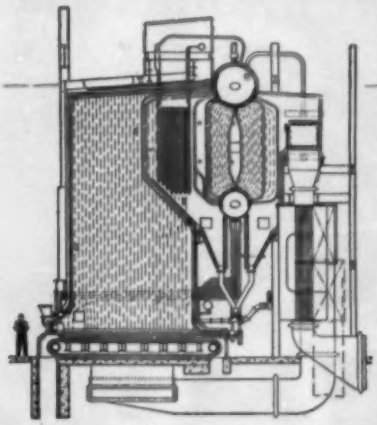


**C-E Package Boiler—Type VP**—The VP Boiler is designed to meet the demand for compact, standardized units in the medium pressure range. It is shipped completely shop-assembled, with firing equipment, fittings, and forced-draft fan. It is enclosed in a reinforced, welded steel, gas-tight casing. Arranged for pressure firing of oil or gas, the VP will burn either fuel exclusively or alternately. Designed for shipment by rail or truck, its width and height remain constant . . . variations are made in length only. Furnace is fully water-cooled, including burner wall, except in three smallest sizes. Large lower drum permits simple, symmetrical tube arrangement and greater water storage capacity.

**Type VP Boiler**—from 4,000 to 30,000 lb steam per hr . . . pressure to 250 psi . . . available for either gas or oil firing . . . fully shop-assembled.



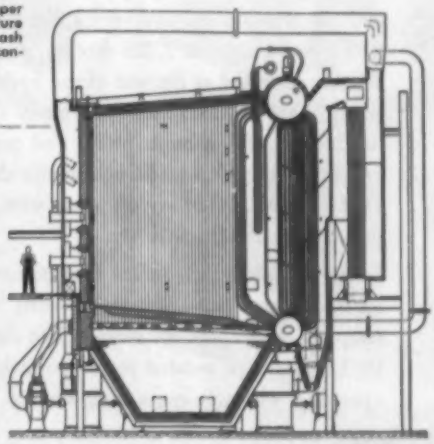
**C-E Vertical-Unit Boiler—Type VU-10**—Like the Type VP Package Boiler, the VU-10 is designed for plants having a limited number of operating and maintenance personnel. It is designed for industrial load conditions and will operate efficiently over a wide range of output. The boiler is bottom supported and has no outside supporting steel. The same general cross-section arrangement of drums, boiler convection bank, and furnace wall cooling is used when firing oil, gas or coal. Coal firing may be with underfeed, spreader, or chain grate stokers.



**Type VU-10 Boiler**—from 10,000 to 60,000 lb steam per hr . . . pressure to 475 psi . . . superheat to 200 F . . . suitable for any type of fuel.

**C-E Vertical-Unit Boiler—Type VU-40**—The VU-40 Boiler is a baffleless boiler designed for use with fuels having abrasive qualities in the flue dust. In a baffled boiler using these abrasive fuels, erosion is apt to occur. In the VU-40 Type Boiler, the eroding action of abrasives against boiler tubes and refractory is virtually eliminated. Like the VU-10 and VU-50, this unit is of symmetrical design, providing uniform gas flow and heat absorption across the full width of the boiler.

**Type VU-40 Boiler**—from 60,000 lb steam per hr up . . . pressure to 1375 psi . . . temperature to 960 F . . . for use with abrasive or high ash content fuel . . . indoor or outdoor type construction.



**C-E Vertical-Unit Boiler—Type VU-50**—With the VU-50 Boiler, the average plant can achieve standards of performance closely approaching those of large central power stations. The basic design was originated by Combustion in 1925 and has been widely accepted among steam-power engineers *everywhere*. Because of its symmetrical design the VU-50 provides uniformity of gas flow, water level and steam release across the full width of the unit. It may be fired by pulverized coal as shown opposite or by any other fuel or method of firing. Heat recovery equipment may be added.

**Type VU-50 Boiler**—from 60,000 to 350,000 lb steam per hr . . . pressure to 1375 psi . . . temperature to 960 F . . . for any fuel or method of firing . . . indoor or outdoor type construction.

8-703A

**COMBUSTION ENGINEERING, Inc.**

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

C-E

Circle 509 on Reply Card for more data

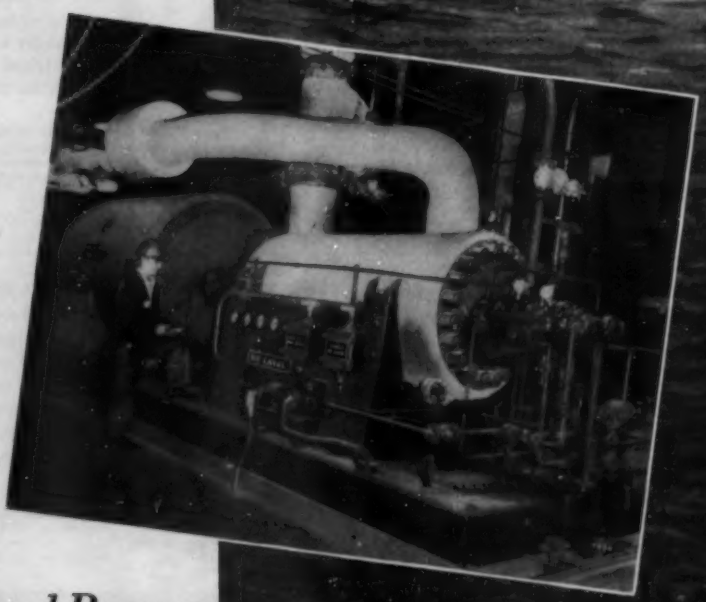
# DE LAVAL
BARREL TYPE
BOILER FEED PUMP

## *in new* Con Edison *Astoria power station*

This De Laval 11-stage barrel type boiler feed pump is now on the line in the new Astoria station of the Consolidated Edison Co. of New York.

The De Laval 8/6 pump operates at 129 psig suction pressure and delivers 1,570 gpm of 344 F water against 2,229 discharge pressure. Direct-connected at the end of the boiler feed pump shaft is a De Laval IMO pump for lubrication of the main pump and motor bearings. Also furnished is a motor-driven De Laval IMO auxiliary oil pump with pressure controlled switches.

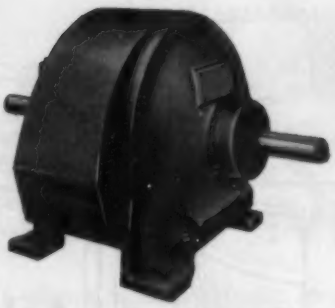
De Laval barrel type boiler feed pumps meet all the requirements of high pressure, high temperature boiler feed service. The distinctive De Laval design assures years of reliable operation with minimum maintenance.



**DE LAVAL** *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY
*857 Nottingham Way, Trenton 2, New Jersey*

DL 895



AIR COOLED COUPLINGS

AJUSTO-SPEDE MOTORS

AIR COOLED BRAKES

ABSORPTION DYNAMOMETERS

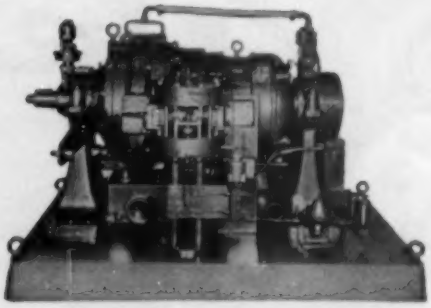
EATON

# DYNAMATIC

## EDDY-CURRENT ROTATING EQUIPMENT

PRESS DRIVES

LIQUID COOLED COUPLINGS



UNIVERSAL DYNAMOMETERS

LIQUID COOLED BRAKES

**D**ynamatic Eddy-Current electro-magnetic equipment represents the ideal solution for a wide range of adjustable-speed drive problems, particularly where an AC power source is a requirement. Typical applications include paper machine drives, cement mill drives, industrial truck clutches, press drives, crane brakes, fan drives—in fact, practically all test, processing, and conveying equipment common to industry. Instantaneous response and accurate control are important advantages.

***Write for your copy of Bulletin GB-1 which describes and illustrates the basic Dynamatic units.***

DYNAMATIC®

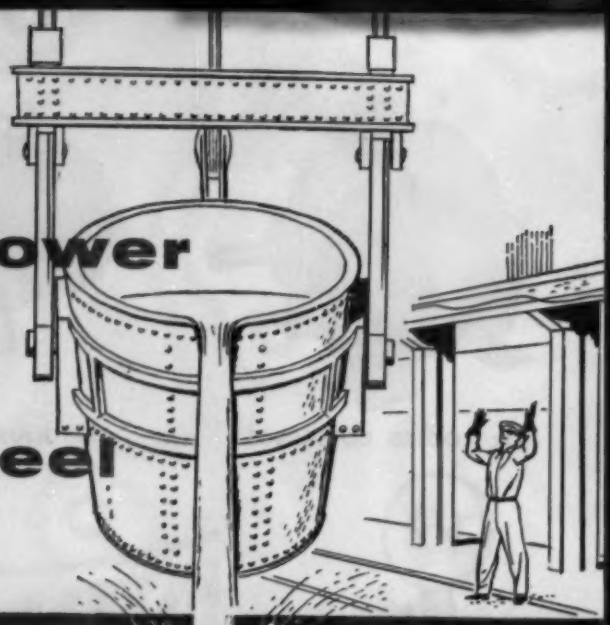
**DIVISION EATON MANUFACTURING COMPANY**

**KENOSHA, WISCONSIN • General Offices: Cleveland, Ohio**

Circle 511 on Reply Card for more data

Circle 510 on Reply Card for more data

# Pouring power into a giant of steel



Dramatic symbol of America's industrial might, U. S. Steel's big Fairless Works is completely new —a giant at birth! From foundations to furnaces, here is an outstanding example of industrial foresight and planning.

Among this huge mill's many impressive innovations is its planned system of power distribution. Substations, switchgear, and circuit breakers—channeling power throughout this giant of steel—are strategically located to provide maximum protection, control, and continuity of service.

Installation of *only the finest* of equipment has been a long tradition at U. S. Steel. Electrical distribution equipment—of fundamental importance—has to be rugged and dependable to fulfill these vital requirements.

# at U.S. Steel's new FAIRLESS WORKS

**kilowatts for a colossus feed**
**through switchgear and circuit breakers built by I-T-E**

Some 70 modern indoor and outdoor I-T-E Unit Substations transform and distribute power throughout the mill. I-T-E Low-Voltage and Metal-Clad Switchgear, as well as Heavy-Duty I-T-E Circuit Breakers, guard the many critical steel processes.

From the start, I-T-E gave important engineering assistance in the preparation of specifications and in expediting *switchgear* orders for the Fairless Works. As a result of this close cooperation, power distribution equipment was on the ground *when needed* to fit right in with tight construction schedules.

Traditionally a supplier of U. S. Steel, I-T-E is proud of its place as a *major* contributor of quality power distribution equipment for the new Fairless Works.

**AT FAIRLESS—**

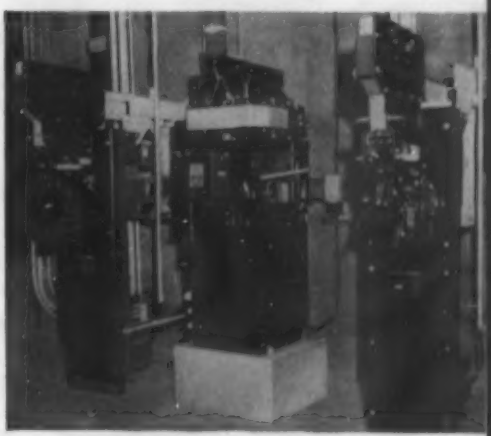
***I-T-E Switchgear protects:***

| | |
|---|---|
| **rolling mills** | **open hearths** |
| **coke ovens** | **maintenance shops** |
| **power house auxiliaries** | **office building** |
| **billet mills** | **car dumper** |
| **strip mill** | **ore dock** |
| **blast furnaces** | **oil bulk storage** |

*For details, contact the I-T-E field office nearest you. Look in your classified directory under "Electric Equipment."*

**I-T-E METAL-CLAD SWITCHGEAR**
installed in cold mill for 2400-volt distribution.

**I-T-E LOW-VOLTAGE SWITCHGEAR**
installed in sheet and tin mill for 480-volt distribution.



**I-T-E HEAVY-DUTY CIRCUIT BREAKERS**
Types MT and OH, used for DC sectionalizing in billet mill.

THE SYMBOL OF QUALITY SWITCHGEAR

**I-T-E CIRCUIT BREAKER COMPANY**
19TH AND HAMILTON STREETS, PHILADELPHIA 30, PA.

**SWITCHGEAR PRODUCTS**

Circle 512 on Reply Card for more data

# new equipment

—Starts on page 10

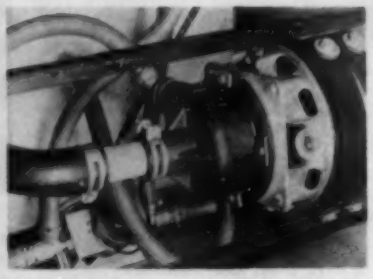
steel by Johnson-March Corp. Housings can be built by the user as a permanent installation or, if made of fabricated steel, as a portable unit. All connections are made conveniently to existing ducts with no need for complicated piping. Neither cloth bags nor filters are used. Eight models are available to handle high temperature gases in capacities ranging from 8000 to 60,000 cfm.

### Packaged combustion system custom designed

**F27** The "Thermopak" unit, with all necessary controls and accessories, will convert any standard fire tube or water tube boiler (from 20 to 525 bph maximum rating) to fully automatic oil-fired or combination oil- and gas-fired operation. "Thermopak" plan includes a complete survey of the heating plant leading to a custom designed package to meet specific requirements.

### Time delay relay with plug-in construction

**F28** Type F Silic-O-Netic Time Delay Relay combining the advantages of the hydraulic-magnetic silicone operating principle with the convenience of plug-in construction is announced by Heinemann Electric Co. Units are for operation on 24 to 220 v ac; 12 to 125 v dc. Contact capacity is 3 amp at 120 v ac or 1 amp at 50 v dc. Detailed information is given in bulletin 5201.

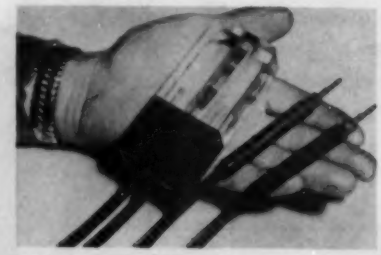


### Pumps made of Hycar handle corrosive liquids

**F29** High capacity, low cost centrifugal pumps made of Hycar American rubber are offered by Gorman-Rupp Industries, Inc. Known as Mansfield Line pumps, these units are non-clogging, quiet in operation, and are used to handle corrosive and abrasive liquids and slurries at temperatures up to 200 F. They are manufactured in various sizes and capacities up to a ½ hp model which can pump 10 gpm at a 45 ft head or 30 gpm at a 30 ft head.

**TO REQUEST ADDITIONAL DATA**

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.



### Electronic voltage tester eliminates mistakes

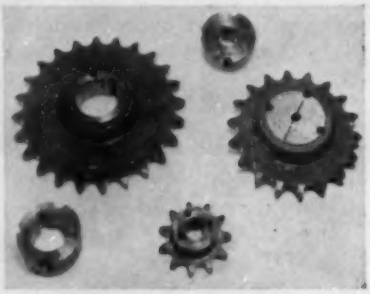
**F30** Electrical voltage tester APL has been developed by the Craft Laboratories for testing circuits from 90 to 600 v. Low voltage lights the bottom part of the scale—higher voltages cause the light to climb in much the same way as a thermometer indicates temperature.

### Control system provides fast motor braking

**F31** Zero-Plugging Control System for the ultra-fast stopping of electric motor driven equipment has been developed by Techniflex Corp. This is a wholly electrical means of developing braking and is applicable to any reversible motor. In instances where holding is required, zero-plugging can be used to take the dynamic braking load while the electro-mechanical brake assumes the holding load only.

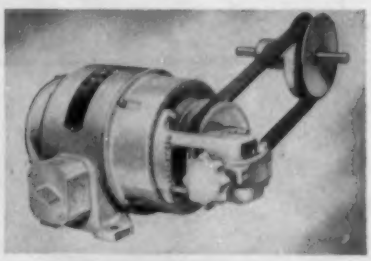
### "Off the shelf" sprocket line extended

**F32** Extension of the "off-the-shelf" line of Taper-Lock sprockets to include the 1½, 1¾ and 2 in. pitch sizes is announced by Dodge Manufacturing Corp. This means that users of single strand roller chain will now be able to secure sprockets and bushings for chain sizes from 40 through 160 direct from distributors' shelves ready for immediate installation without delay for reboring, keyseating, drilling, and tapping.



### Line of roller chain sprockets expanded

**F33** Taper-Lock roller chain sprockets in both single and double hub types are now available in an expanded line of stock sizes for No. 120 (1½-in. pitch), No. 140 (1¾-in. pitch) and No. 160 (2-in. pitch) chain from Morse Chain Co. All stock Taper-Lock sprockets in the new sizes up to 26 teeth are approximately 0.40 carbon steel and can be flame hardened to order.



### Motor and drive mounted as single unit with adapter

**F34** Reuland Electric Company's motor features a special adapter end bell for direct mounting of Reeves Flexi-Speed Drives. This development eliminates need for a separate, foot-mounted index support and permits the mounting of both the motor and drive as a single, compact, well aligned unit. Motors already adapted to this direct mounting system are available in the

# ALL FORGED STEEL

# Edward
# CHECK VALVES

## *for freedom from vibration, clatter and piping shock*

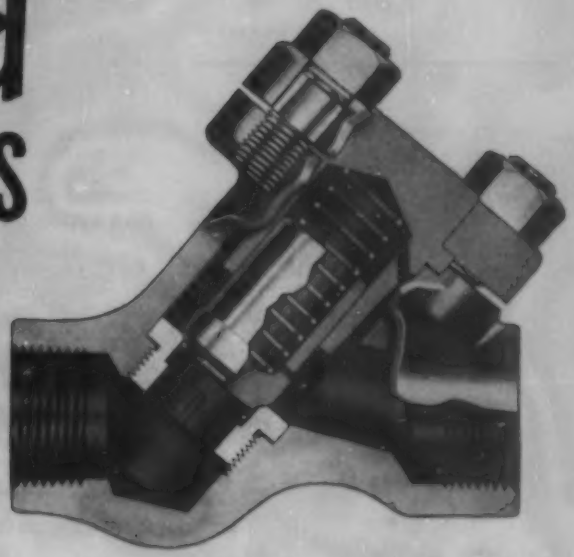


FIG. 4638,5538

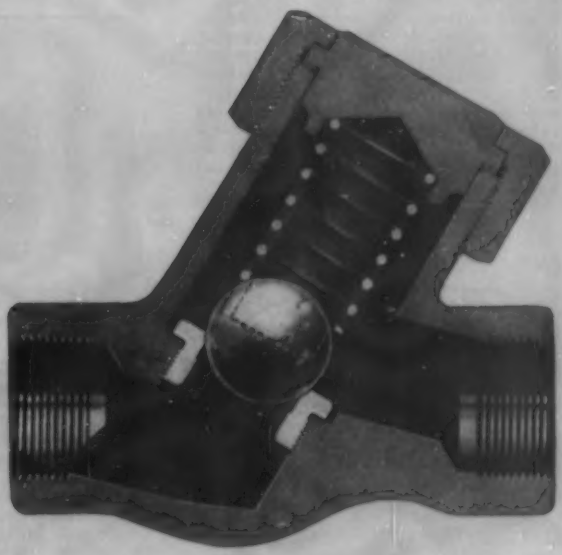


FIG. 2672,3572

**For all piping systems requiring small check valves, Edward furnishes a complete line of forged steel valves in both principal check valve types:**

**PISTON TYPE CHECK VALVES** for extra advantage in lines where it is important that the disk closes tightly upon the seat. Careful design of internal parts gives full flow area, low head loss, avoids excessive shock. Exclusive disk guide lip and spring loading for quick positive seating. Available with stellite contact faces on seat and disk on special order.

**BALL CHECK VALVES** are ideal where heavy viscous fluids are encountered. Bodies are of specially heat treated forged steel. The stainless steel ball of special EValloy high chromium stainless steel is guided by two steel ribs. A spring aids in seating the ball on the carefully lapped seat.

### AVAILABLE IN WIDE RANGE OF SIZES AND STYLES

- √ 600, 1500 and 2500 lb sp pressure classes
- √ Horizontal or vertical types
- √ Screwed, flanged or socket welding ends
- √ Union, bolted or welded bonnet
- √ Ball or piston type disk
- √ In ¼", ⅜", ½", ¾", 1", 1¼", 1½" and 2" sizes

### GET ALL THESE PLUS FEATURES:

- √ Extra strong and long spring of stainless steel for sure closing action
- √ Rated for 600 lb sp at 850F, 1500 lb sp at 850F and 2500 lb sp at 1000F
- √ Extra strong bodies of specially heat treated forged steel
- √ Cushioned closing action eliminates excessive vibration
- √ Fit any piping arrangement, vertical or horizontal
- √ Corrosion proof stainless steel seats and disks or balls
- √ Accessible removable seats
- √ Easy disassembly if needed
- √ Streamlined body contours for free flow, low pressure drop

**In addition to forged steel check valves, Edward builds a complete line of larger cast steel check valves—there is an Edward valve for every check valve application. Write for complete information.**

## Edward Valves, Inc.

**Subsidiary of ROCKWELL MANUFACTURING COMPANY**
**40 W. 144th St. • East Chicago, Indiana**

Another Product

Circle 513 on Reply Card for more data

# new equipment

—Starts on page 10

following ratings: ½ and ¾ hp in 1800 or 1200 rpm input speeds; 1 hp in 1800 rpm input speed.

### Catalytic muffler tames diesel exhaust

**F35** A catalytic muffler that effectively reduces the noxious and irritating components of 4-cycle diesel engine exhausts has been developed by Oxy-Catalyst, Inc. Called the Dieseler, it attaches directly to the engine exhaust manifold and burns by catalytic action the noxious carbon monoxide and odorous hydrocarbon fumes in exhaust gases. The illustration shows the Dieseler and one of the Catalytic units (Oxycats) that make up the exhaust system.

### Glass fiber adapted to automatic filter

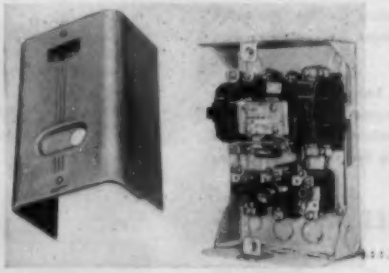
**F36** Designed for use in commercial and industrial ventilating and air conditioning systems to clean both outside and recirculated air, the Roll-O-Matic automatic self-cleaning air filter introduces a new adaptation of glass fiber filtering media. A pressure switch sensitive to resistance differential across the filter curtain actuates a drive motor that rotates the screen and feeds a certain amount of clean surface into the filter curtain when the resistance reaches a pre-determined point. American Air Filter Co.

### Compound repairs, fills, and builds up metal

**F37** Aluminum compound Metalset (A 101) developed by Smooth-On Mfg. Co. is used for repairing castings, filling joints in sheet metal, and building up surfaces of patterns, molds, and dies. It hardens by polymerization following the addition of a curing agent, and not through evaporation of a solvent. It is hard, tough, machineable down to a feather edge, and has excellent chemical stability.

**TO REQUEST ADDITIONAL DATA**

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.



### Starters offer three-coil protection

**F38** The Cutler-Hammer motor starter offers three-coil protection in the same size enclosure as the two-coil starter. Feature of the three-coil starters is an adjustable heater coil that allows four different ratings from a single coil. Motor protection is said to be within three percent of usable motor load as compared with the 10 to 12 percent otherwise offered. Literature is available.

### Sealer can be painted over immediately

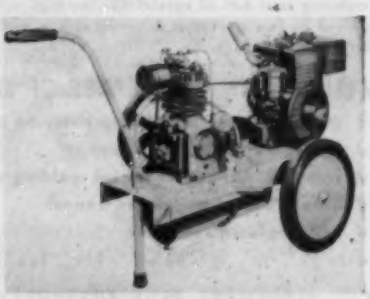
**F39** Announcement of non-staining, non-hardening tough extruded sealer comes from Presstite Engineering Co. Capable of being painted over immediately after application, No. 155 Elastic Compound Tape is used to seal metal seams and joints, to seal glass and rubber channels, and as an anti-squeak material. The sealer has no softening or crazing effect on plastics. Samples and details are available.

### Gas fired space heaters added to line

**F40** Heating Department, Machinery Div., Dravo Corp. announces the addition of two gas fired warm air space heaters to supplement its line of Paraflow oil fired heaters. Known as the Model 20-G with a capacity of 200,000 Btu per hour, and the Model 25-G with a capacity of 250,000 Btu per hour, the new units are suitable for use with natural, manufactured or mixed gases, or liquified petroleum.

### Plastic drawer cabinet

**F41** The ideal way to carry parts right to the job, this plastic drawer cabinet made by General Industrial Co. has locking front doors and a non-slip handle. Welded all-steel cabinet is tested to carry 100 lb load.

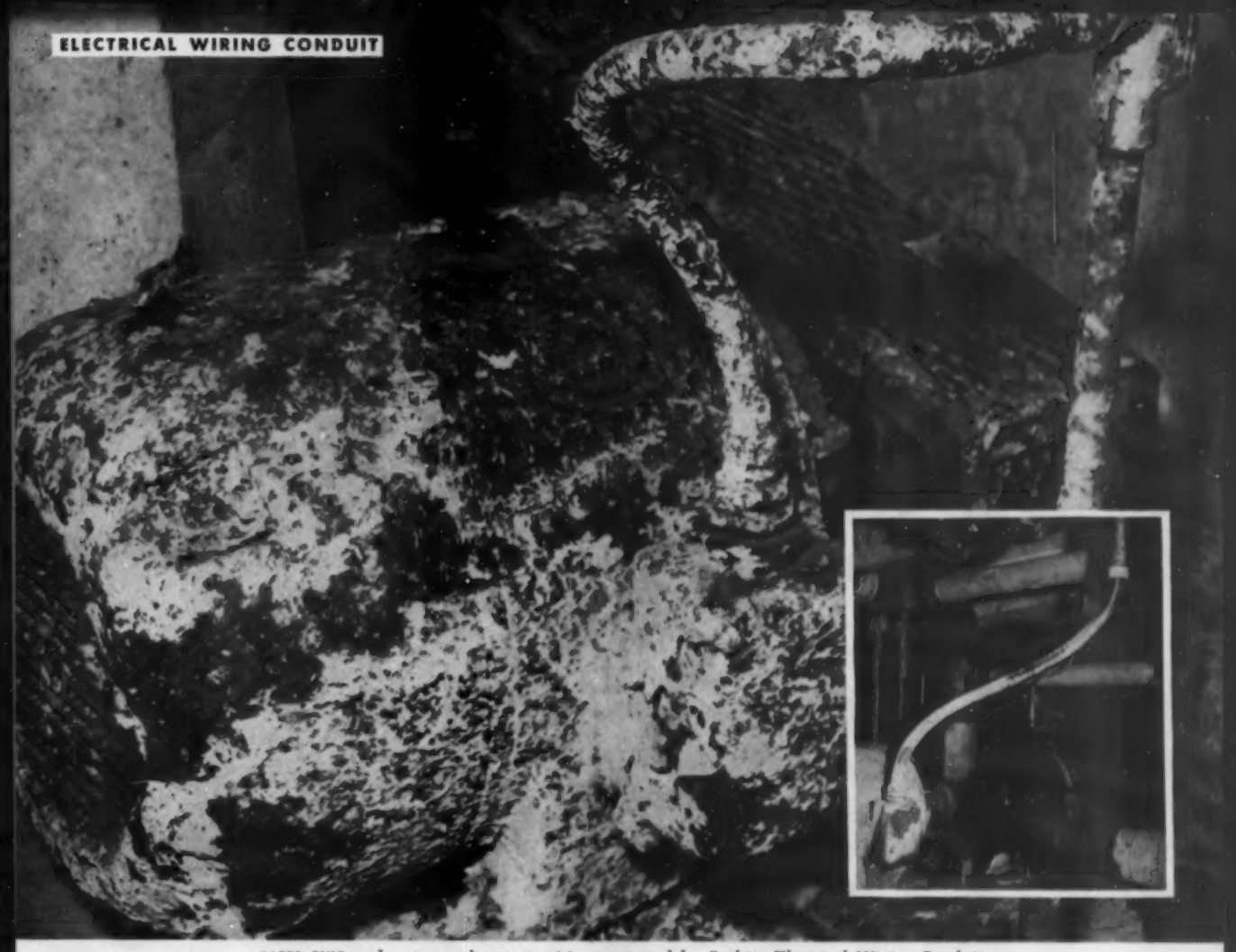


### Compressors available with electric or gasoline motor

**F42** Portable air compressors in a variety of models introduced by the DeVilbiss Co. are available with either electric or gasoline motor. One hp model rated at 60 lb maximum pressure delivers 5.4 cfm. For general utility work a ½ and a one hp compressor both have 100 lb maximum ratings. The one hp unit delivers 4.2 cfm and the ½ hp model 1.91 cfm.

### Change in supercharging results in higher ratings

**F43** The National Supply Co., Engine Div., announces that its Model 65 supercharged 6 and 8 cylinder stationary diesel engines are now




**PAPER PULP** and water can't get at wiring protected by Sealtite Electrical Wiring Conduit.

# Sealtite Flexible Conduit shrugs off daily dose of water, paper pulp, oil and chemicals

The Sealtite* Electrical Wiring Conduit shown above is hooked up to motors which drive machines used to make paper. It's as rough a service for wiring conduit as you'll find. Air is hot and steamy. Floors are wet. Oil, chlorine, caustic soda and wet pulp come in daily doses.

Ordinary conduits fail rapidly under such attack. But Sealtite's tough synthetic cover shrugs it off. Wiring can't be damaged. It's protected against foul-up and corrosion.

Sealtite is light and flexible. It installs easily in cramped spaces. It absorbs vibration—takes movement. It hugs motor contours . . . looks neat.

Circle 514 on Reply Card for more data

Sealtite Type U. A. is the first conduit of its type to be approved by Underwriters' Laboratories, Inc. for use where exposed to moisture and mineral oils (see N. E. Code, Art 351). For tight bends on machine tools and industrial equipment, use Sealtite Type E. F.† (Extra Flexible). It meets standards set by J. I. C.

Electrical wholesalers stock both types in coils. Buy it this way; then cut without waste. Wholesalers also stock standard liquid-tight connectors for use with Sealtite.

†Pat. Applied For *Trademark

**SEALTITE**

**flexible, liquid-tight electrical conduit**

**as ANACONDA® product**

**The American Brass Co., American Metal Hose Branch, Waterbury 20, Conn.**

Please send me descriptive booklets on Sealtite Electrical Wiring Conduit.

NAME.....

PLEASE PRINT

COMPANY.....

STREET.....

CITY..... ZONE..... STATE.....

64174

# 24 ACRES *Cover the World*

**. . . with TOP QUALITY**

**DROP FORGED STEEL**

## VALVES, FITTINGS and FLANGES

*by*

# Vogt

Air View of Henry Vogt Machine Co.

This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

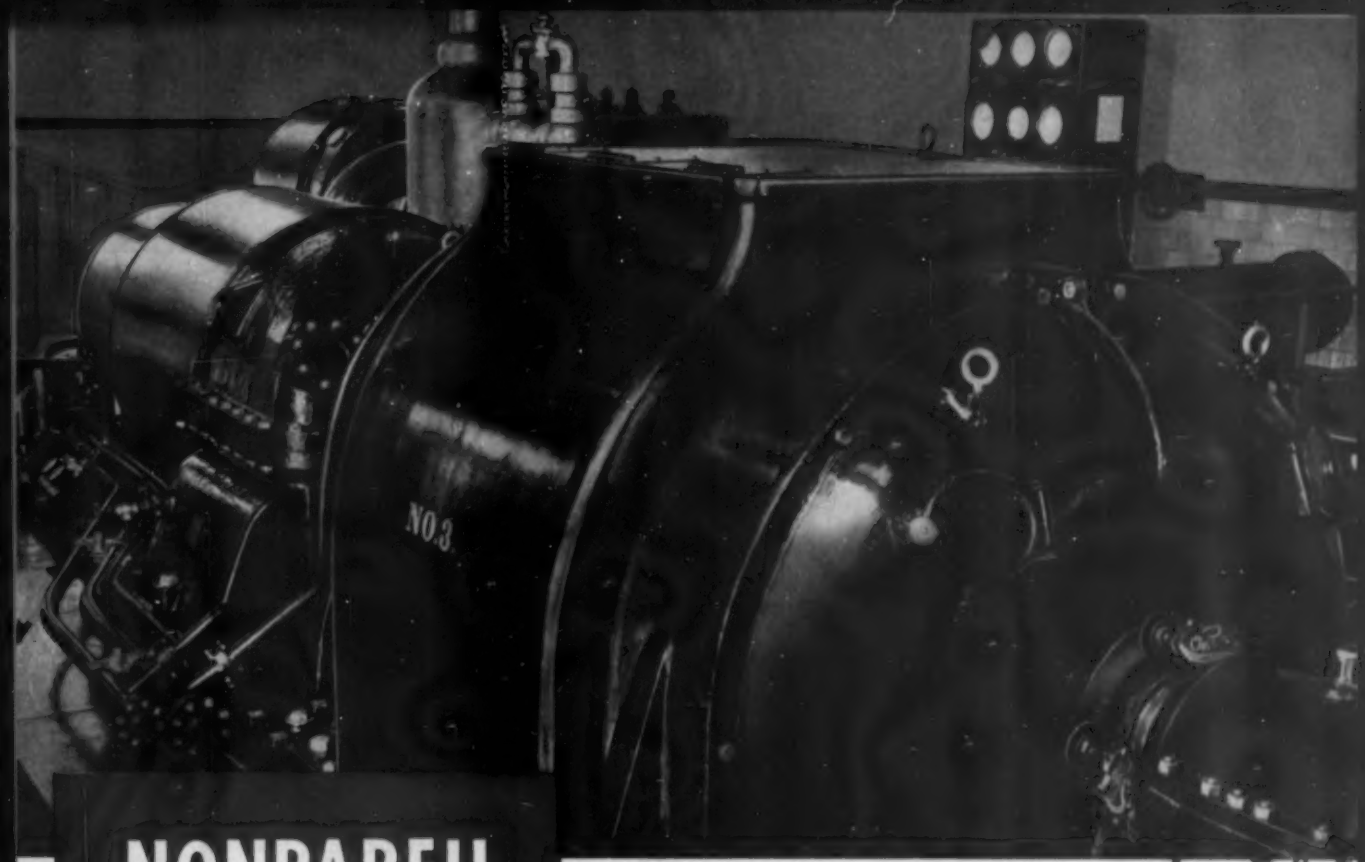
**OUR COMPLETE LINE INCLUDES**

Flanged, Screwed and Socket Weld End Globe, Gate and Check Valves • Ells, Tees and Crosses • Couplings • Bushings • Plugs • Unions • Flanges and Flange Unions • Welding Heads

**HENRY VOGT MACHINE CO. LOUISVILLE 10, KY.**

**Branch Offices: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.**

Circle 515 on Reply Card for more data




**NONPAREIL**
TRADE MARK
**Turbine Oil**

## How they eliminated turbine oil replacements

● Operators of this midwest power plant recall the time when a conventional lubricant was used in the plant's three turbines (now, four). A fill of oil was good for about three years and then it had to be replaced because of increased acidity and other indications of oil deterioration.

In 1939, a Standard Oil lubrication specialist recommended NONPAREIL Turbine Oil, and the switch was made. Since that time, none of the original fills of NONPAREIL has needed to be replaced. For that matter, no fill of oil has needed to be removed from its turbine for any purpose. Lubrication systems have remained clean. Neutralization numbers of oil fills have stayed below 0.06 mg. KOH/gm. Fourteen years of trouble-free turbine lubrication is just the beginning for this plant. Each fill of NONPAREIL is guaranteed in writing to last as long as the turbine it lubricates and to maintain a neutralization number below 0.15 mg. KOH/gm.

Ask the Standard Oil lubrication specialist serving your area of the Midwest to show you how NONPAREIL and its written guarantee will assure you of completely trouble-free lubrication for the life of your turbines. Phone your local Standard Oil office. Or, write: Standard Oil Company, 910 So. Michigan Ave., Chicago 80, Ill.

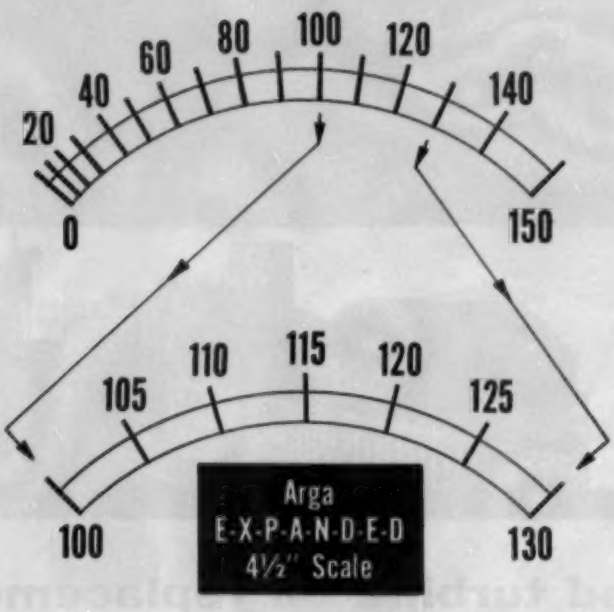
**STANDARD OIL COMPANY** STANDARD *(Indiana)*

Circle 516 on Reply Card for more data

# Arga

## E-X-P-A-N-D-E-D SCALE A. C. VOLTMETER

**Conventional 4½" Scale**




**SPECIFICATIONS**

- **ACCURACY — ½% input voltage**
- **FREQUENCY RANGE — 50-2000 cps**
- **BASE VOLTAGE — 115, 120, 208, 230 volts**
- **SPAN — ±5, ±10, ±15 volts**
- **SIZE — 3½" or 4½" — Panel Mounting**
- **SHAPE — Round or Square**

***Write for Data File 88-116***

**Arga** *division*

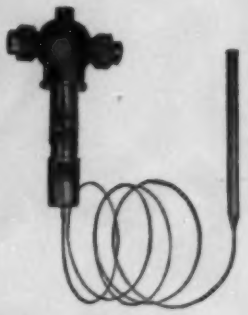
**BECKMAN INSTRUMENTS, INC.**
SOUTH PASADENA 1, CALIFORNIA

Circle 517 on Reply Card for more data


# new equipment

*—Starts on page 10*

available with output ratings of 1325 and 1765 bhp respectively. The higher ratings are the result of a change in supercharging, which raises the bmep to 152 psi. Reprinted bulletin 5202 lists the new ratings of the two types of engines.

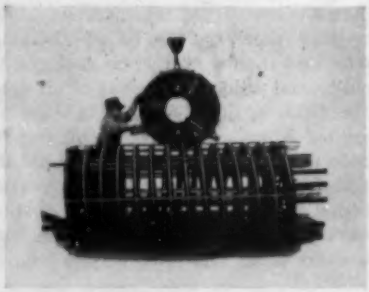


### Thermostat valve combines accuracy and long life

**F44** Designed for dependable, low-cost temperature control on small storage tanks, plating tanks, bottle and can washers, driers, and industrial washing machines, No. 1449 tank thermostat valve is tight-closing type. Made by Klipfel Valves, Inc. it is available in sizes from ¾ to 1 in.

### Metal primer applied over rust

**F45** Metal primer known as Ospho, developed by Rusticide Products Co., stops rust action when applied directly over rust. Not a paint, it can also be used as a primer for new metal. Paint is said to adhere better to metals coated with Ospho, thus reducing maintenance time and cost.



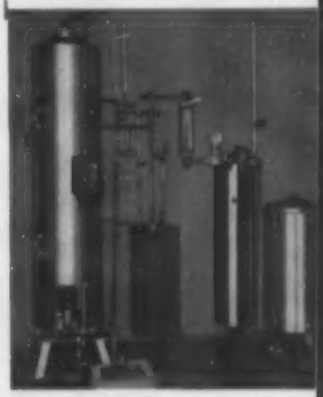
### Fin and pipe coils available in stainless steel

**F46** Rempe Co. announces completion of facilities and techniques for the fabrication, welding, and finishing of pipe and fin coils in stainless steel. Fin type coils can be furnished

there's a
GENERAL FILTER
unit

# JOB ENGINEERED

to fit every
water conditioning need
in your plant



Whatever your problem . . . General Filter Company's trained staff of engineers and chemists have served industry for the past 20 years and are qualified to produce quality water to meet the most exacting specifications. All GFC water conditioning equipment is designed, engineered and built under rigid quality-control . . . actually job-engineered to guarantee the successful operation of the completed installation. And General Filter equipment is designed with a practical eye on cost and space saving features too. For further information, just mail the coupon today.

General Filter Company
AMES, IOWA

*... better water*

Circle 518 on Reply Card for more data

*write for these FREE booklets today!*

**GENERAL FILTER COMPANY,** Dept. IP6, Ames, Iowa

Gentlemen: Please send us further information on the subjects checked below.

- ☐ AERATORS
- ☐ ALKALINITY CONTROL
- ☐ DEMINERALIZATION
- ☐ FILTERS
- ☐ IRON RUST REMOVAL
- ☐ SOFTENERS
- ☐ TASTE AND ODOR
- ☐ HIGH CAPACITY RESINOUS ZEOLITE
- ☐ HAVE ENGINEER CALL
- ☐ _____

NAME _____ TITLE _____

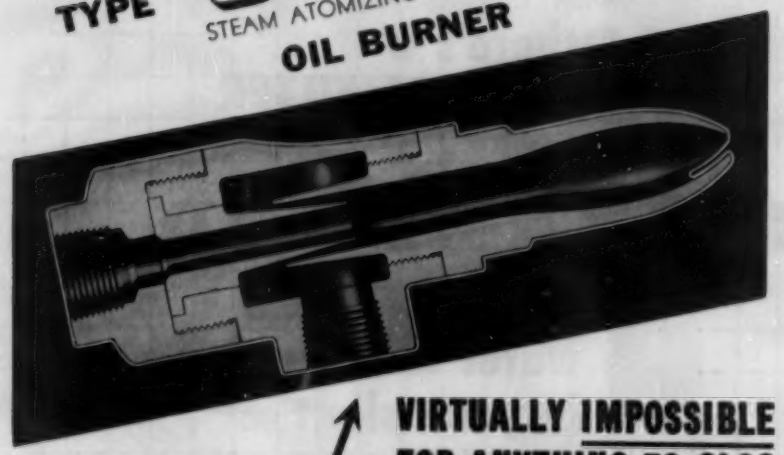
ADDRESS _____

FIRM _____

CITY _____ ZONE ____ STATE _____

# NATIONAL AIROIL

## TYPE "SA" STEAM ATOMIZING OIL BURNER



**VIRTUALLY IMPOSSIBLE FOR ANYTHING TO CLOG OR GO WRONG...**

## ...SEE FOR YOURSELF!

**The popular NATIONAL AIROIL Steam Atomizing Oil Burner *thoroughly* atomizes and *completely* burns the lowest and cheapest grades of fuel oil or tar . . . requires only minimum supervision and maintenance. Only slight oil pressure and temperature is needed . . . and internal atomizing venturi feature assures a low steam consumption. NATIONAL AIROIL Type "SA" Oil Burner is adaptable to all types of industrial heating, power or process furnaces . . . is suitable for firing above stoker grates on conversion to oil.**

**Other "SA" modifications designed for: the burning of Colloidal fuel ("SAR")—Large capacity operation ("SAL")—Sludge burning ("SAD")—Combined steam and mechanical atomization (Dual Stage).**

***WRITE FOR BULLETIN 21***

OIL BURNERS and GAS BURNERS for industrial power, process and heating purposes
STEAM ATOMIZING OIL BURNERS
SLUDGE BURNERS Steam Atomizing
MOTOR-DRIVEN ROTARY OIL BURNERS
MECHANICAL PRESSURE ATOMIZING OIL BURNERS
DUAL STAGE, Combining Steam and Mechanical Atomization
LOW AIR PRESSURE OIL BURNERS
NAIROIL AUTOMATIC OIL BURNERS, or small process furnaces and heating plants
GAS BURNERS
COMBINATION GAS & OIL BURNERS
FUEL OIL PUMPING and HEATING UNITS
FURNACE RELIEF DOORS
AIR INTAKE DOORS
OBSERVATION PORTS
SPECIAL REFRACTORY SHAPES

**NATIONAL AIROIL BURNER CO., INC.**

1391 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.

Southwestern Division: 2512 South Boulevard, Houston 6, Texas

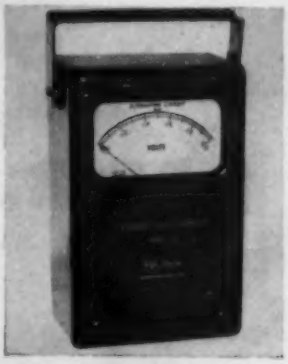
**INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT**

Circle 519 on Reply Card for more data


# new equipment

—Starts on page 10

gas tight or standard. Pipe coils can be designed for individual requirements from all types of stainless steel, from a combination of dissimilar metals, or from aluminum, Monel, copper, nickel, or lead.



### Voltmeter scale expanded

**F47** Arga Expanded Scale Voltmeters offer overvoltage protection, wide expansions of ±5, 10, 15 v at 115 or 230 v. The instruments are designed for applications where exceptional ruggedness and reading ease are required. Arga Div., Beckman Instruments Co., Inc.

### Light output up 35 percent in new fluorescent lamp

**F48** To supplement the existing high-efficiency, low-brightness fluorescent lamps, General Electric Co. has developed a lamp which produces 35 percent more light. First of the new lines is a standard cool white lamp eight feet long with a 1½ in. dia. Rated at 110 w, it has a total output of 6800 lumens and a rated life of 7500 hours.

### Valves are non-seizing

**F49** Republic Manufacturing Company's Lo-Temp Valves are said to be smooth turning in any service or at any temperature within their range. With a plug made of Teflon, no lubricant is needed to prevent seizing; the valve is leakproof. The plug is unaffected by acids, alkalis, or gases.

# Two Terry Turbines equipped with "trouble eliminators"

Because these turbines have solid wheels, they can take a lot of abuse, without complaint. Here's why:

1. The wheel has no separate parts to become loose or work out. It is a single forging, in which a series of semi-circular buckets is milled.

2. Blade wear is of little consequence because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets. Wear does not materially affect horsepower or efficiency.

3. The blades cannot foul. There is a one inch clearance on either side of the wheel and, in addition, the blades are double rim protected. There is no need for close axial blade clearance, because the steam enters the buckets in a direction at right angles to the shaft.

For complete details of these *work horses of industry*, send for a copy of bulletin S-116. No cost or obligation.

**THE TERRY STEAM TURBINE CO.**

TERRY SQUARE, HARTFORD 1, CONN.

TERRY

TT-1199

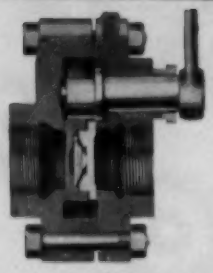
Circle 520 on Reply Card for more data

# EVERLASTING VALVES

## Mean "Everlasting" Protection on these duties

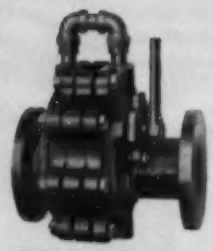
**BOILER BLOW-OFF**

Quick-opening, also hand-wheel operated. Angle and "Y" types and combination units meeting ASME Code requirements for pressures up to 600 psi.



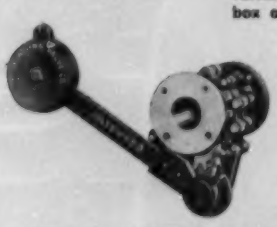
**GENERAL SERVICE**

Wherever frequent use and quick operation is required for any liquid or gas at pressures up to 300 psi. These valves have outside stuffing box and gland.



**STEAM JACKETED**

Assure continued free flow of any material which congeals at ordinary temperatures.



**EMERGENCY PROTECTION**

Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.

**CYLINDER-OPERATED VALVE**

for accurate control of process work. Straight-through flow, drop-tight seal, air or hydraulic control for operation at any speed.

## EVERLASTING FEATURES

For more than 40 years, EVERLASTING VALVES have been known for their ingenious design, simple, sturdy construction, and long trouble-free life with low maintenance expense. Some of their distinctive features are:

**Quick-Action** . . . Opened or closed with less than a quarter turn of the operating lever.

**Straight-Through Flow** . . . the disc cannot become loose and accidentally check the flow.

**Drop-Tight Seal** . . . constant contact of disc and seat at all times prevents dirt or scale from getting between.

**Self Regrinding** . . . the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

**No Wedge Action** . . . all parts move between parallel faces.

***Write for bulletin describing* EVERLASTING VALVES *in detail.***

EVERLASTING VALVE COMPANY 41 Fisk Street, Jersey City 5, N. J.

**Everlasting Valves**

TRADE MARK "EVERLASTING" REG U S PAT OFF

EV-301

*for everlasting protection*

Circle 821 on Reply Card for more data


# letters

. . . from readers

### Strictly for the birds

Sir:

A substation here in our plant is comprised of a 25,000 kva—66/13.8 kv, 3 phase transformer and eight units of double-bus switchgear. This substation is located adjacent to six-6000 kva rectifier transformers. In recent months the roosting of birds in and above this important installation has become a serious problem. The droppings from these birds are not only making a complete mess of the entire area, but are also causing flashovers on the 66 kv insulator stacks which result in the destruction of the insulators and costly shutdowns.

The utility serving this area has informed us that they have similar problems and, after trying many schemes from poison bait to firing a blank cartridge from a gun, have found no effective solution.

We have been told that supersonic sound waves have been tried as a means of repulsing birds from public buildings in some cities. We have been unable to find any installation of this type or any report as to its success or failure.

If you have knowledge of any installation utilizing supersonic sound for this purpose, or any research performed in this direction, we would certainly appreciate any information that you might be able to pass on to us. In addition, please inform us if you know of any other method of solving this "bird problem," or any individual, company, society or agency we could consult.

L. E. Vorderbrueggen
Electrical Engineer
Columbia-Southern Chemicals

—We cannot find any examples of the application of supersonic sound to drive away birds, although everyone "seems to have heard of it but doesn't remember where." The most practical solution, and one that has worked, involves the application of chemicals which the birds seem to dislike. Details of the process are available from National Bird Control Laboratories, 1035 W. Lake St., Chicago, Ill.

Among the suggested solutions to the problem which have reached the editor's desk are:

Set up stuffed owls all along the

## R/M's BIG 7 Packing Types meet 95% of all packing needs

TYPE 4

*Rotary pumps like this one, which handles 10 gallons of highly viscous materials (10,000 SSU) per minute at 1200 rpm, give top performance with R/M No. 376, a packing included in Type 4 of R/M's Big 7 Packing Types.*

# Let R/M packings protect your machines

Increased machinery protection is one of the very real advantages you get when you standardize on R/M's Big 7 Packing Types. The reason is that they're engineered to give custom-built performance in all but the very rarest packing applications. You can also count on this basic line of just seven field-tested packings to lower your maintenance costs, cut your downtime, reduce your inventories, and simplify your ordering. It will enable you to practice preventive rather than corrective maintenance. The entire requirements of your plant can probably be met with just three or four of R/M's Big 7 Packing Types. For details, see your R/M distributor.

R/M PACKINGS FOR MAINTENANCE PURPOSES ARE SOLD ONLY THROUGH AUTHORIZED R/M DISTRIBUTORS

RM

**RAYBESTOS-MANHATTAN, INC., PACKING DIVISION, MANHEIM, PA.**

**BIG 7 PACKINGS**

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada.

RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Bowling Balls

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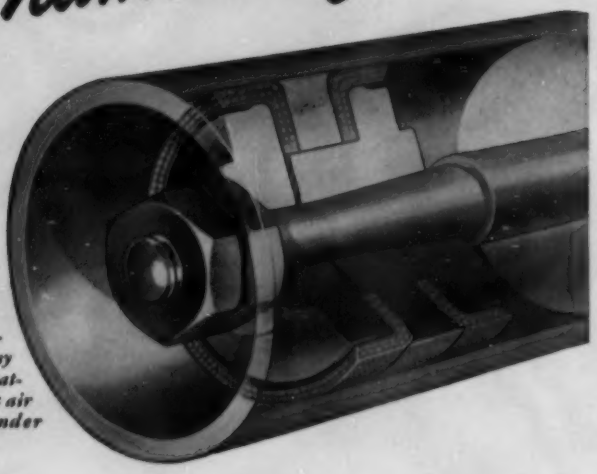
# You name the fluid...



*Phantom cutaway showing typical Pumcup-piston assembly—one of many types for all reciprocating pumps as well as air or hydraulic cylinder mechanisms.*

## Here's how to pump it at lower cost!

IN thousands of plants, Darcova Pumcups are solving the problem of diminishing pump efficiency, repacking, maintenance, down-time, lost production—the things that really eat up dollars in fluid-handling operations! Here's why . . .

1. Darcova composition Pumcups not only increase volumetric efficiency, but they *keep* it high with no appreciable fluid slippage for the entire life of the Pumcups.

2. And, because of their design, composition, and operating principle, Pumcups have *many times the life* of most other types of piston packing.

3. Based on years of application research, Pumcups come in standard and special compositions for exceptional stability in handling almost *any* fluid you can name. For example . . . strong acids and alkalies, food products and even the most troublesome petroleum derivatives.

*Big* savings? We'll gladly refer you to Pumcup users whose problems are similar to yours. *They'll* tell you! Meanwhile, send for a free bulletin containing helpful, more detailed information. Bulletin 4401 on Pumcups for reciprocating pumps; Bulletin 4502 on Pumcups for air and hydraulic mechanisms. Just write to . . .

**DARLING VALVE & MANUFACTURING CO.**
**WILLIAMSPORT 9, PA.**

DARCOVA
THE ORIGINAL COMPOSITION CUP

**PUMCUPS**

Circle 523 on Reply Card for more data


# letters

—Starts on page 30

fence. This involves the problem of finding a good source of stuffed owls.

Catch one of the birds and hold it upside down by its legs in front of a tape or wire recorder. Record its squawks, and play back over a good size amplifier placed in the birdridden area.

Sprinkle salt on their tails.

Any reader with other ideas should write the editor.—Ed.

### Once Upon a Time

Gentlemen:

I wish to present most hearty compliments to Mr. Hunt for his very fine article "Changeover From DC to AC," March INDUSTRY AND POWER. His experience brought to mind a somewhat similar experience we struggled through in the early history of the iron mining industry in northern Wisconsin.

Some strange and biazrre happenings were experienced by those hardy souls who, blessed with more brawn than brains, attempted some rather large scale cutovers with but limited knowledge of the emperical fundamentals of ac. There was an instance where the cutover was really simplified by merely exchanging ac for dc at the service entrance and supplying new current and potential transformers and coils, plus meters. It was only when the metal cabinets and conduits began to glow red with induced current that some one realized you just could not transmit ac with one phase per conduit.

Paul C. Siemke
Oak Ridge, Tenn.

### Wood Burning Furnace

Gentlemen:

At the suggestion of Mr. Robert E. Betts, of Texas Engineers Library, we are writing to see whether you can provide us with information or references on down-draft furnaces which convert logs to charcoal and then consume them.

Pauline Bonnean
Brazoria County Library

Angleton, Texas

—Northeastern Wood Utilization Council, Inc. New Haven 6, Conn. has available for 25¢ a pamphlet entitled "A Homemade Wood Burning Furnace."—Ed.

**SECOND WORTHINGTON TURBINE GENERATOR** installed at the Kohler Co. in Kohler, Wisconsin. Steam is extracted from this 6000-kw unit at the rate of 120,000 lb/hr. at 225 psi and 80,000 lb/hr. at 5 psi.

# KOHLER OF KOHLER selects Worthington again

In 1949, Kohler of Kohler, manufacturers of plumbing fixtures, heating equipment, electric plants, air cooled engines and precision controls, installed their first Worthington turbine generator.

The 3000-kw Worthington unit operated in parallel with the outside power supply and delivered the rated kw load while automatically extracting 120,000 lbs. of steam per hour at 225 psi for heating and process work.

Because of the extremely economical and dependable operation of this machine, another Worthington turbine generator was the logical choice when power requirements increased. In November of 1952, a 6000-kw Worthington turbine generator was installed.

Now the two Worthington units furnish process steam for the plant and also supply a large part of their electrical requirements.

Follow the lead of Kohler and find out how Worthington turbine generators can pay off for you, too. Write to Worthington Corporation, Steam Turbine Division, Section T.4.5, Wellsville, New York.

T.4.5

**WORTHINGTON**

**STEAM TURBINES**

Single- and Multi-Stage Turbines • Turbine-Generators • Deaerators • Boiler Feed Pumps • Surface Condensers

**A GREAT TEAM IN STEAM**

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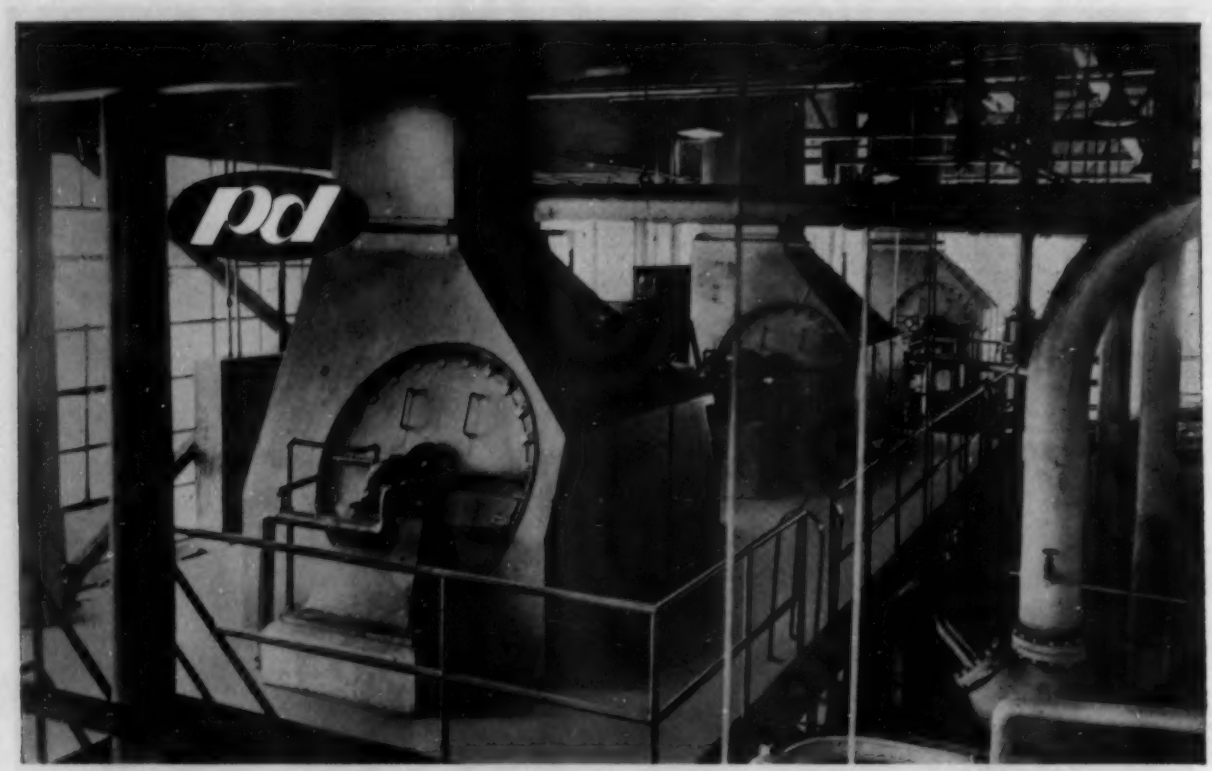


# P-D Dust Collectors and Fan Stacks Provide Maximum Flexibility and Unit Efficiency at Western Electric

## sturdy, self-supported units... clean cut layout arrangements

It takes steam—lots of steam—to keep Western Electric's big Indianapolis plant turning out millions of telephones each year. During processing, sizable quantities of steam are needed and in addition over a million square feet of factory and office space must be heated.

The system that solves this problem is designed to deliver 187,000 lbs. per hour of steam, from three 60,000 lb. per hour steam generators and a 7,000 lb. per hour, incinerator boiler. The four units are equipped with an integrated arrangement of Prat-Daniel Dust Collectors, Induce Draft Fans, Breechings and Stacks. Small diameter tubes in the P-D Collector develop a high centrifugal force, providing maximum operating efficiency even at widely varying loads. The straight P-D Fan Stacks are of sturdy self-supporting construction. Flow through arrangement reduces resistance, providing more efficient draft production.

Engineered by Allen and Kelly of Indianapolis in collaboration with Western Electric's engineers,

SINGLE FAN TYPE TWIN FAN TYPE

Stacks and Dust Collectors were project engineered by The Thermix Corporation.

You too can have specialized help in solving your dust and draft problems. Call or write Thermix today.

*Ask for the new P-D Catalog 4P201.*

*Project Engineers*

**THE THERMIX CORPORATION**

GREENWICH, CONN.

*(Offices in 38 Principal Cities)*

*Canadian Affiliates:* T. C. CHOWN, LTD., Montreal 25, Quebec; Toronto 5, Ontario

*Designers and Manufacturers*

**PRAT-DANIEL CORPORATION**

SOUTH NORWALK, CONN.

POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

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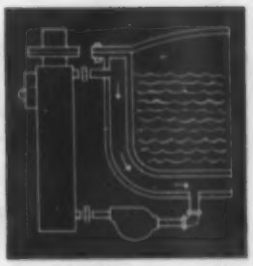
**For controlled heating of liquids and gases**

# CHROMALOX

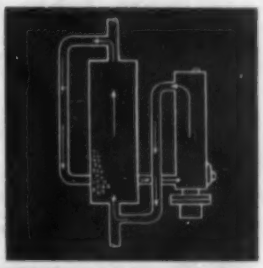
## *Electric Circulation Heaters*



Circulation heater connected to jacketed process kettle.

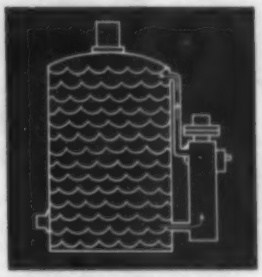
## including

- **Water, oils and heavy fuel oils.**
- **Nitrogen, steam, air and other gases.**
- **Aroclor, Dowtherm, Prestone and other heat-transfer mediums.**



Circulation heater as part of nitrogen heating assembly for reactivating alumina.

Chromalox Electric Circulation Heaters are "packaged" heaters ready to install and connect wherever you need dependable heat that is efficient, economical and easy to use. They give you measured quantities of heat up to 750° F. that can be accurately controlled and maintained around the clock. May be used in series. Available in capacities from 1 kw. to 100 kw. in standard voltages.



Circulation heater connected to water tank as "side-arm" heater.

**CHROMALOX CATALOG 50**

contains complete data on Chromalox Circulation Heaters for all applications. Write for your copy today.

*This coupon will bring you catalog 50*

IC-72

**Industrial Division, EDWIN L. WIEGAND COMPANY**
**7520 Thomas Boulevard, Pittsburgh 8, Pa.**

Please send me Catalog 50.

Name_____

Company_____

Street_____

City_____ Zone_____

State_____

**CHROMALOX**

*Electric Heat for Modern Industry*

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# new bulletins

**. . . catalogs from leading manufacturers**

### 200—Circular Clarifiers

Installations of circular clarifiers are illustrated and the various applications of this equipment are discussed in five-page bulletin AH-442. Also included are several typical flow sheets and a brief description of auxiliary apparatus such as digestors and floculating equipment. Hardinge Co., Inc.

### 201—Instrument Piping Valves

Four-page data unit 234 contains illustrations and drawings showing how this company's valves combine unions, nipples, reducers, elbows, tees, valves, and drain valves into one space-saving unit. Application information, specifications, and features are included on valves for instrument piping and general use. Jerguson Gage & Valve Co.

### 202—Relief Valves

Catalog 207, 23 pages, gives a brief description of the major advantages of this company's pressure regulating and relief valves to assist you in the selection of the proper valve for your specific application. Tables give capacity factors and basic steam and water capacities. Schade Valve Manufacturing Co.

### 203—Grommet V-Belts

Grommet V-belts in standard and high capacity constructions are featured in eight-page catalog 2170. New horsepower rating tables permit the design or redesign of V-belt drives at reduced cost. Cutaway drawings illustrate the Grommet construction — load-carrying cords concentrated in twin grommets. B. F. Goodrich Co., Industrial Products Div.

### 204—Standby Power

Technical bulletin T-011, 16-pages, covers the installation of emergency standby electric generating plants and automatic line transfer controls in easy to understand language. Descriptions of the plants, method of control, and easy-to-understand wiring diagrams are included. D. W. Onan & Sons, Inc.

### 205—Centrifugal Pumps

Two-stage centrifugal pumps, Type UNB, adaptable to boiler feed, refinery, mine, and other services where moderate heads and high capacities are involved are described in two-page data sheet W-318-S27. A section drawing points out design features. Worthington Corp.

### 206—Dust and Fume Control

To meet the need for technical information, simply presented, on dust and fume control this company is offering four-page bulletin W-7083. The type VW-3 centrifugal wash collectors described are package units combining exhauster and precipitator. Ducon Co.

### 207—Level and Pressure Control

"Chronoflo Level and Pressure Telemeter," bulletin 230-K10 describes the application of Chronoflo Telemetering to level control in reservoirs and elevated and ground storage; to pressure control in pump discharge lines, distribution systems, booster stations, industrial processes, steam and gas lines; and to automatic pump control. Builders-Providence, Inc.

### 208—Butterfly Valves

Bulletin 1701, 11 pages, which replaces catalog 1700, contains specifications of continental butterfly valve bodies and the new Series 800 diaphragm motor operators. Complete tables of allowable pressure differentials are included to facilitate selection of properly sized bodies and operators. Minneapolis-Honeywell Regulator Co., Ind. Div.

### 209—Simplified Boilers

The new line of simplified Powermaster packaged automatic boilers in sizes 15 through 100 hp, light oil or gas, are discussed in eight-page bulletin 1230. Details of design and construction, a cutaway view, and sample specifications are given. Orr & Sembower, Inc.

### 210—Motorpump Selection

A slidefilm in printed form, 15-page booklet 7123, points out the various factors, such as the quantity, pressure, friction losses, and head, that must be considered in selecting a motorpump to meet a specific installation. It presents a typical problem and its solution, by means of material shown on previous pages, such as charts and curves. Ingersoll-Rand Co., Cameron Pump Div.

### 211—Automation

Because of the increasing interest in automation, 12-page booklet 7M5C deals with the application of timers in the designs of machines for automatically handling and machining or processing parts and materials. A section of the booklet clearly catalogs the many available timers into "reset" or "repeating cycle" types. Eagle Signal Corp.

### 212—Roof Maintenance

Illustrated, simplified "do it yourself" handbook 3R, 12 pages, on all types of roof repair contains many detailed close-ups and sketches telling how paper, metal, gravel, and concrete roofs can be simply renewed and completely waterproofed by the 3R process, which is efficiently handled by plant maintenance crews. Colonial Refining & Chemical Co.

### 213—Electrical Modernization

"Compete or Collapse," 16-page booklet B-6133 shows how a modern electrical system can increase output, lower operating costs, reduce down-time maintenance, increase safety, and reduce protective rates. Westinghouse Electric Corp.

### 214—Acid-Proof Cement

Instructions for mixing and application of Staminite Acid-Proof Cement are given in four-page bulletin R-783-37. Included are an estimating table and strength data. The Robinson Clay Product Co.

### 215—Pump Sequence Systems

An improved automatic system for varying the number of pumps needed to satisfy fluctuating demands in multiple pump installations is described and illustrated in four-page catalog 91-106. The heart of the system, the Ori-Flowrator meter, is explained in detail. Fisher & Porter Co.

### 216—Water Treatment

A system for treating municipal and industrial water supplies which continuously softens by base exchange resins and continuously regenerates the resins with brine is explained in four-page bulletin 4063. A graphic wash drawing and photograph show basic components of the unit known as the Dorrco Hydro-Softener. The Dorr Co.

### 217—Heat Exchangers

Included in 35-page catalog 533012 will be found capacities, sizes, dimensions, and weights of fuel oil heaters, condensate coolers, built-in water heaters for large steel boilers, tank heating units, straight tube water heaters, tanks with heating units, converters, and large size water heaters of various types. Taco Heaters, Inc.

### 218—Pressure Loss Calculator

Printed on this slide-chart calculator which quickly estimates pressure drop and indicates proper size steam valve needed for any pressures up to 1500 psi are full operating instructions and necessary technical data. Golden-Anderson Valve Specialty Co.

### 219—Unit Heaters

One of the most complete compilations of material on propeller fan type unit heaters is available in 48-page bulletin 700. Indexed, the booklet is broken down into sections on horizontal and vertical heaters, selection and application, installation information, specifications, and dimensions. Herman Nelson Products, American Air Filter Co., Inc.

### 220—Miniature Venturi Tube

Type TF Venturi, a small unit specifically designed for the measurement of

NOTE — Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 34/35 & 98/99.

# if you want lower V-Belt costs—

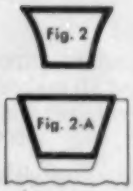
When a V-Belt bends, you can feel its sides change shape.

## just make this simple test

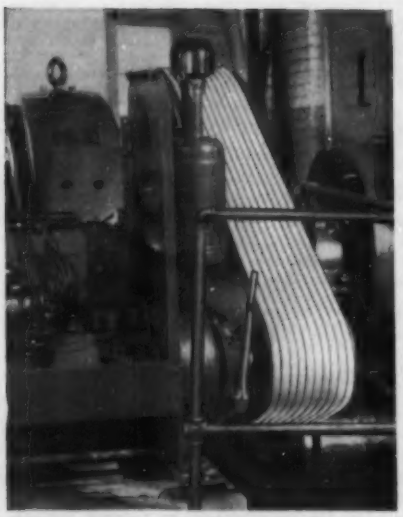
Take *any* V-belt that has *straight* sides (Fig. 1). Bend that V-belt while you grip its sides with your fingers. You will *feel* the sides *bulge out* (Fig. 1-A). Clearly, that out-bulge forces the belt to press *unevenly* against the V-pulley—and this *concentrates* wear at the points shown by arrows (Fig. 1-A).

### Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)

(U.S. PAT. NO. 1813698)




Instead of *bulging*, the precisely engineered CONCAVE SIDES merely *fill out* and become perfectly straight. This belt, when bent, *precisely fits* its sheave groove (Fig. 2-A). The sides of the Gates Vulco Rope press *evenly* against the V-pulley. Therefore, wear is distributed *uniformly* across the *full face* of this belt —resulting in *longer* belt life and *lower* belt *costs* for you!



Typical Gates Vulco Rope Drive —the Gates V-Belts are built with Concave Sides to insure longer belt wear.

When you buy V-belts, be sure to get the V-belt with the Concave Sides—the Gates Vulco Rope!

Gates VULCO ROPE DRIVES

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Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and Canada, and in 70 other countries throughout the world.

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DENVER, U.S.A.

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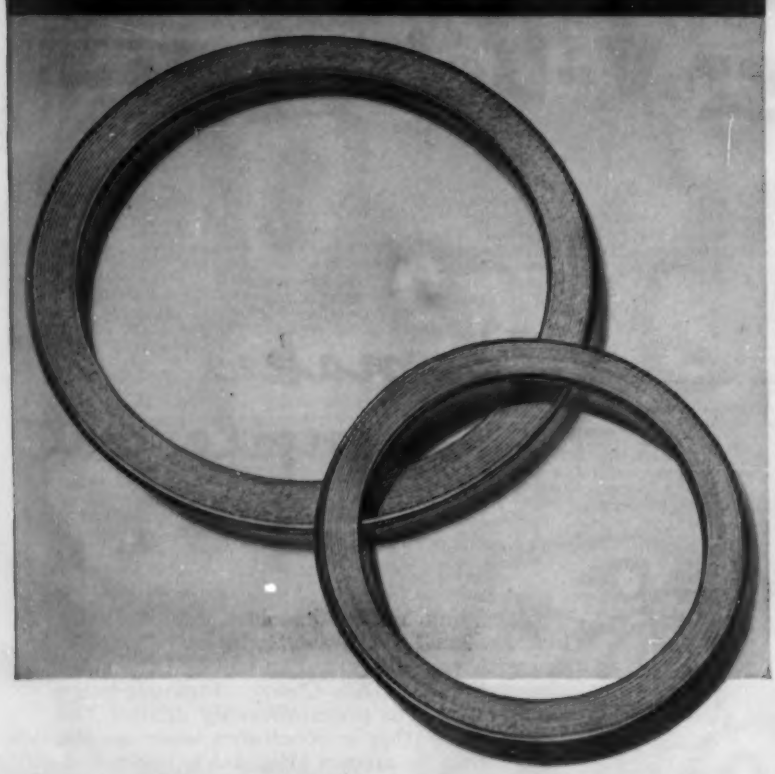
# SPIRALWOUND



## World's Most Popular Type Metal-Asbestos Gasket

Spirally wound Type Gaskets deserve their popularity because they offer a built-in resiliency, for safe seals with lighter bolt-loads, that no other gasket type offers.

Ajax Spiralwound Gaskets are made for all standard pipe flanges and for manholes, handholes and tube caps of all makes of stationary and marine boilers, waterwalls, economizers, and other boiler accessories.

They are available in plated low-carbon steel or stainless with fillers of Canadian or blue African Asbestos or chemically inert duPont Teflon.

Ask your Industrial Distributor or write—

**UNITED STATES GASKET COMPANY**

CAMDEN 1 • NEW JERSEY

FABRICATORS OF duPont TEFLON, Kellogg KEL-F AND OTHER PLASTICS

Representatives in Principal Cities Throughout the World

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# new bulletins

—Starts on page 36

fluids in quantities ordinarily considered too low for the application of a normal size Venturi or orifice is described in this five-page technical bulletin. Pictures of individual components before assembly, a completely integrated unit, limitations of application, uses, and discharge capacities are listed. Simplex Valve and Meter Co.

### 221—Industrial Fans

Helpful information concerning cooling and drying problems, system ventilation, and open surface tank ventilation is included in 11-page booklet 650 on Type CS Tubeaxial and Type CSB Stackbooster fans. Full page chart can be used to figure duct resistance. Propellair Div. of Robbins & Myers, Inc.

### 222—Test Plugs

"Quick-Seal" plugs and filling connectors designed to save time and labor and provide maximum safety in sealing or connecting air or hydraulic test lines to such units are described in eight-page catalog 354. Self-sealing, expanding-seal, and compression-seal principles are shown by means of cross-sectional drawings. Mechanical Products Corp.

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### 223—Maintenance

Choosing the right equipment for the job is made easy by breaking down maintenance work into four classifications: painting and cleaning; electrical work and equipment maintenance; plant repair and maintenance; and special jobs, according to revised eight-page bulletin G-205R. This booklet is a guide to ladders and scaffolding that will help you cut maintenance costs. Patent Scaffolding Co., Inc.

### 224—Industrial Water Softener

This two-color booklet contains complete data on valves, as well as detailed chart-type specifications on the many sizes of Ilico-Way softener units, showing individual model numbers, exchange capacities, flow rates, size of units and meters, volume of mineral, amount of salt, and shipping weight. Three basic types of exchange materials are thoroughly described. Illinois Water Treatment Co.

### 225—Semi-Automatic Washer

Electro-cell maintenance has been materially simplified and improved by the introduction of Type H Washer according to four-page pamphlet 252-E3-5M. Dimensional drawings show front and side elevations and general plan. The washer described provides semi-automatic washing for intermediate or average installations where manual maintenance is not practical. American Air Filter Co., Inc.

### 226—Door Catalog

Information valuable to engineers, architects, and building management executives, such as designs for turn-over, bi-fold, and telescoping canopy doors and vertical lift, slide, turn-over, and special-purpose doors is given in this 15-page

# "How modern coal equipment saves us $9,000 a year and solves our smoke problem!"

**Says Albert E. Unruh,**
**Chief Engineer**
**University of Detroit**
**Detroit, Michigan**

**This is a smokestack.** This beautiful War Memorial Tower actually conceals the smokestack for the U. of Detroit's steam plant. Though it's in the very center of the campus, there's never any smoke problem, thanks to a modern coal-fired power plant.

**"Again and again over the last decade,** coal burned with modern equipment has proved itself the most flexible, economical fuel for heating our school buildings. We made our first investment in modern coal equipment shortly after the last war. By 'restokering' two existing boilers, we saved $9,000 the first year—actually $2,500 more than we estimated. At the same time, we solved a disturbing smoke and flyash problem and provided enough steam capacity to heat additional new buildings.

**"We're completely sold on coal.** And when our building expansion program required us to further increase steam production, we again chose a modern coal-fired boiler. Coal has proved its ability to handle increased loads and save us dollars year after year. And modern equipment eliminates smoke nuisance."

*Additional case histories, showing how other types of plants have saved money by burning coal with modern equipment, are available upon request.*

**If you want to cut steam costs,** it will pay you to investigate the advantages of modern coal equipment. For example, you may be able to save as much as 20% on fuel alone by replacing outdated equipment with modern stokers and boilers. Or, a small investment in modern controls and other up-to-date, fuel-conserving devices may boost efficiency of your present operation.

**You can save on labor, too,** by installing modern handling equipment. Modern coal-feeding and ash-removal systems can eliminate practically all hand labor.

**Call in a consulting engineer.** He can give advice on what equipment best fills your specific needs. And his recommendations may save you dollars year after year.

**If you operate a steam plant, you can't afford to ignore these facts!**

- **BITUMINOUS COAL** in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*
- **COAL** production in the U.S.A. is highly mechanized and by far the most efficient in the world.
- **COAL** prices will therefore remain the most stable of all fuels.
- **COAL** is the safest fuel to store and use.
- **COAL** is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

**BITUMINOUS COAL INSTITUTE**
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*FOR HIGH EFFICIENCY — FOR LOW COST*

# *YOU CAN COUNT ON COAL!*

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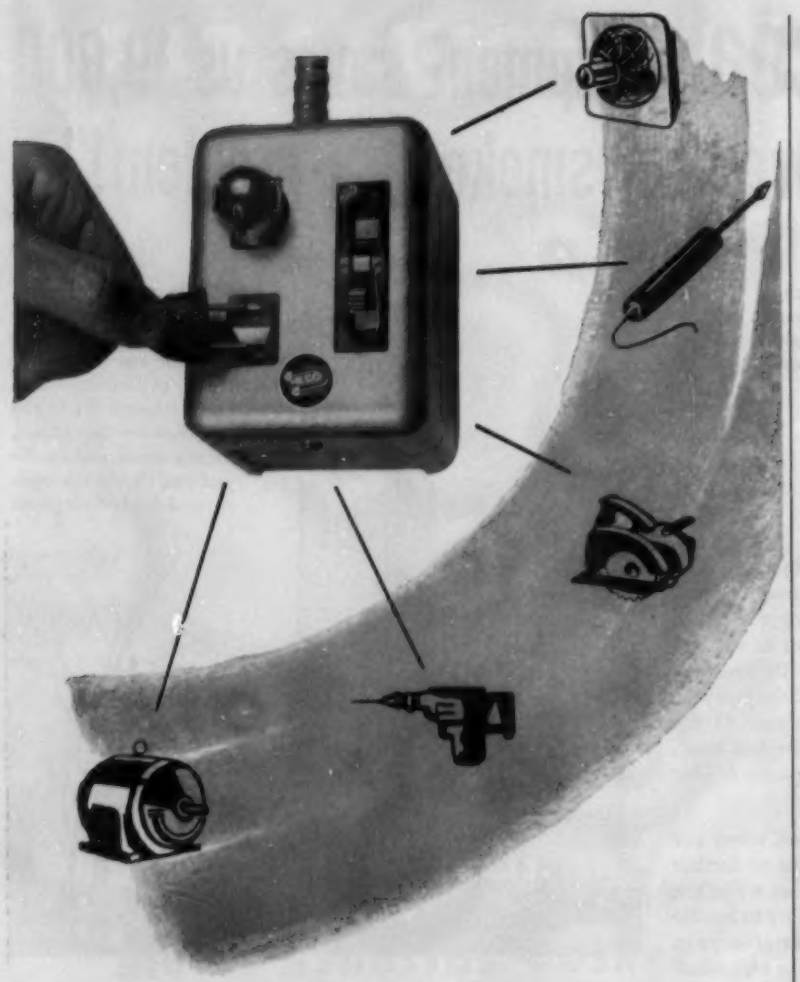

# SAFELETS are *safe outlets* . . . for on-the-spot overload protection

Wherever electrical appliances or power tools are used . . . wherever the danger of overloading exists . . . there's need for a *Safelet*.

A unique individual protection station, the *Safelet* is another practical application of the Heinemann Circuit Breaker. It interrupts short circuits or large overloads instantly, yet allows normal inrush or harmless overloads. The circuit breaker is combined with a convenience outlet in an attractively styled metal wall-box.

*Safelets* protect either the branch circuit wiring or equipment plugged into the line. They are available in ratings up to 15 amperes, and, for protection of fractional horsepower motors, in ratings up to 1 hp. An optional feature is a pilot light which shows when the circuit is in use. Several types of female receptacles are available.

*Safelets* are safe outlets for power tools, soldering irons, exhaust fans, oil burners, air conditioners and miscellaneous small appliances. Installed in your plant, they can save many hours of down time, many dollars in equipment repair and replacement costs.

For details, write for Bulletin 1010.

HEINEMANN ELECTRIC COMPANY
140 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

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# new bulletins

—Starts on page 38

catalog. Construction and operational details are shown. International Steel Co.

### 227—Dry Film Lubrication

The latest answers for the solution of difficult lubrication problems due to extreme heat, excessive cold, inaccessibility, high speeds, high loads, galling, seizing, and excessive wear are presented in this file folder. How dry film lubricants solve problems where other lubricants fail is told by means of case histories. Electrofilm, Inc.

### 228—Weed Killer

Striking examples of the efficiency of "Telvar" W weed killer are shown by means of "before" and "after" photographs in nine-page booklet A-6644. How to get best results is explained. E. I. du Pont de Nemours & Co.

### 229—Steam Generation

"Instrumentation for Steam Generation," 28-page bulletin 9050 is a convenient, one source reference for all products of Honeywell's Industrial Division applicable to steam generation. Plant engineers will find this bulletin useful in selecting instrumentation for modernization. Minneapolis-Honeywell Regulator Co.

### 230—Supersensitive Analyzer

The day of the canary is gone. Four-page pamphlet 501 describes a gas analyzer capable of measuring toxic and hazardous gases in parts per billion. Flow diagram explains operation of the unit. Taller & Cooper, Inc.

### 231—Blast Cleaning Accessories

Accessories and supplies available for use with Pangborn blast cleaning equipment are described in 28-page bulletin 300C. Accessories include: helmets, gloves, hoses, nozzles, aprons, blast room accessories, and repair parts. Several pages are devoted to correct selection of abrasives. Pangborn Corp.

### 232—Planning Panelboards

Planning commercial and industrial circuit-breaker panelboards is discussed in 16-page booklet B-6098 including advantages of De-ion circuit breakers, and of the dead-front breaker panel to both user and contractor. A new panelboard specification — considerably shorter and less time-consuming than the older type — is suggested. Westinghouse Electric Corp.

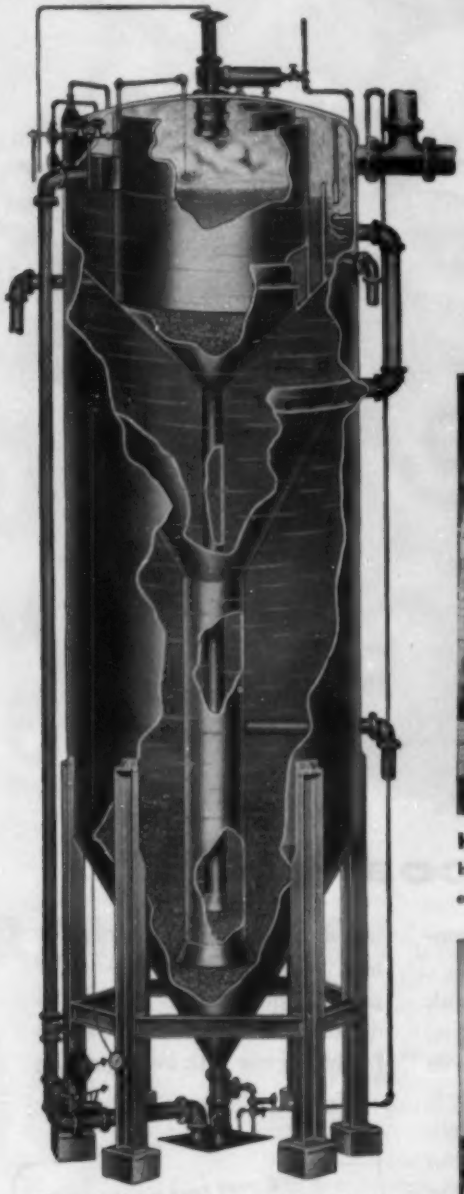
### 233—Cooling Towers

Water treatment for cooling towers is the subject of six-page bulletin 28X7501A. It discusses types of cooling systems together with such problems as corrosion of metal surfaces, inorganic scaling, organic growths such as algae and bacterial slime, and delignification of the wood in tower. Allis-Chalmers Mfg. Co.

(Continued on page 98)

# *In Hot Process Softening, too*

# BELCO Builds a Complete Line-



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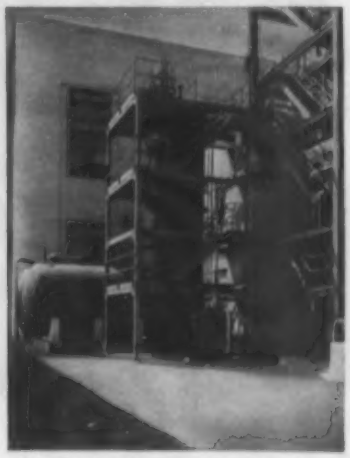
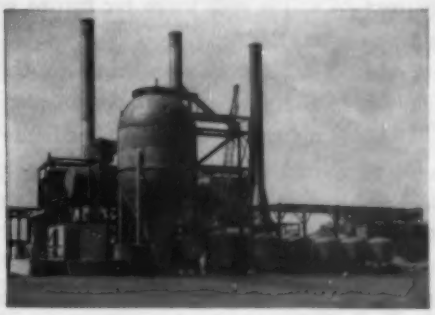
*Processes for Removal of Water Impurities*

**Belco-designed equipment provides high operating efficiency at low operating costs. Many of the country's largest industries rely on Belco for their water conditioning equipment. For example, Belco has built the largest fully automatic demineralization plant in the world and is currently furnishing one of the largest hot lime zeolite installations. A consultation with Belco could lead to lower operating costs for you, too. Write or call for technical assistance at any time.**

**HOT LIME SODA** — Installation in boiler house at large eastern oil refinery. Has capacity of 200,000 lbs/hr.



**HOT LIME SODA** — Installation in large southwestern utility. One of three units with 90,000 lbs/hr total capacity.



**HOT LIME BELCOLITE** — Installation at large southern chemical company. Capacity 600,000 lbs/hr. This plant embodies "thoroughfare" operation of separate deaerator and hot process tank. The large hot process tank was designed, built and erected by Belco under its contract with customer.

*Boiler Feedwater Heaters • Water Softeners • Filters • Clarators*
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# "All day I watch the coal go by!"

*"Train after train. Day and night. Year after year. You wonder where it all comes from and how long it can last."*

• • • • • • • •

You're right, Pop, it's a lot of coal—close to half a billion tons a year. Yet, in the more than a century this country has been mining coal, we have used up only a little over one percent of our known supply. 98.8% of the coal that nature put under our soil is still there for future generations.

That is something to think about when you are considering a new heating plant for home or industry. Other fuels will be getting scarce. Every year the wells go deeper. More and more of our fuel oil comes from foreign fields. Growing scarcity can mean uncertain supply and higher relative prices.

Coal you can be sure of. There will be a plentiful supply for many centuries to come. And the price advantage that makes coal a most economical fuel today is likely to grow with every passing year.

COAL
FUEL OF THE FUTURE

## Chesapeake and Ohio Railway

**Bring your fuel problems to C&O**

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you promptly.

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2110 Terminal Tower
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# R/M V-BELTS

If you use equipment powered by multiple V-belt drives, you can step up production efficiency — and lower costs — with R/M V-Belts. R/M Super-Power V-Belts and Condor V-Belts are the smoothest running V-Belts made because every part of their construction is precision-balanced. Straight sidewalls on these V-belts provide more grip, less slip, trouble-free performance. They last longer and do more work, too. On some drives you can count on 40% greater horsepower capacity with R/M Super-Power V-Belts as compared to regular V-belts . . . or do an equal job with fewer belts!

Whatever your particular V-belt needs, either R/M Super-Power or Condor is your assurance of longer belt life, improved performance and greater drive economy at your plant . . . "More Use per Dollar". Consult an R/M representative. Ask him about R/M Hose, Transmission, Conveyor Belts and other industrial rubber products for every use . . . in every industry.

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Flat Belts · V-Belts · Conveyor Belts · Hose · Roll Covering · Tank Lining · Abrasive Wheels

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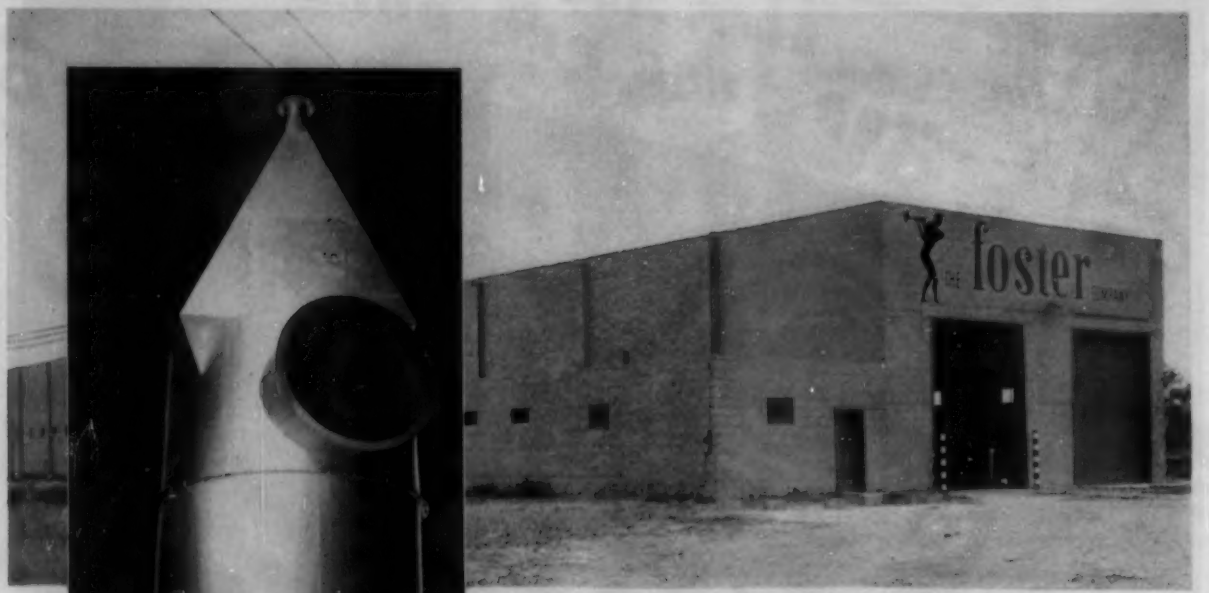
# AFTER-COOLER FOR NEW DETROIT FOUNDRY



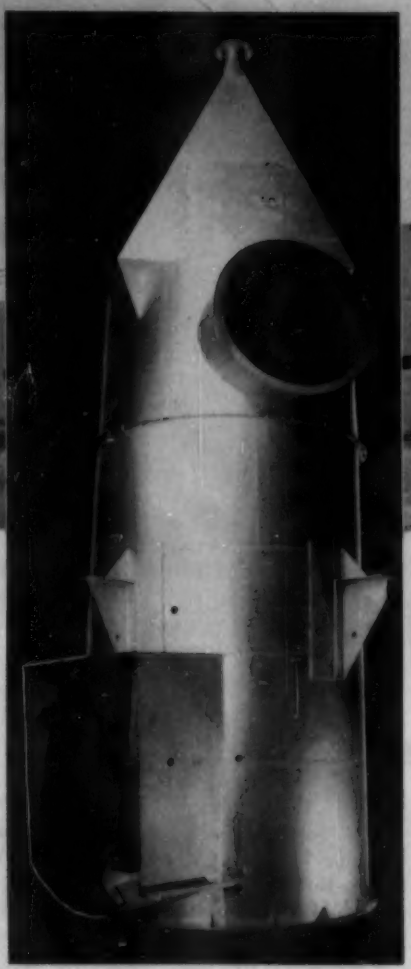



Photo at left shows one of two cooling chambers, integral components of vortex type dust collectors. Special design by Grindle Corporation eliminates dust, fumes, general smoke nuisance from expanded cupolas and stacks of major Detroit automobile manufacturer.

After-cooler pictured above is typical of heavy *precision* weldments manufactured by Foster. New building has heavy duty over head crane facilities; houses new equipment for shearing, burning, bending, braking, forming, annealing, sand-blasting.

Raw materials from nearby Gary-Chicago mills; deliveries by motor freight, railroads, barges via Illinois and St. Lawrence Waterways.

Tho costs are moderate, fine quality and agreed delivery are sole standard at Fosters.

THE **foster** COMPANY ST. JOSEPH, MICHIGAN

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# NO Reducing Valve Needed

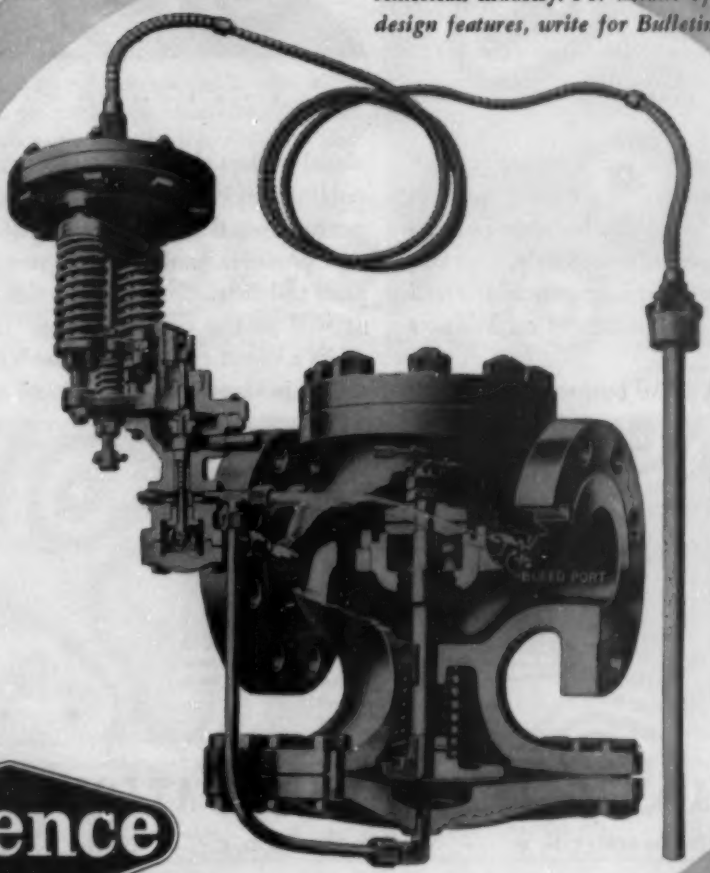
**Here's real economy in temperature control.**

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



SPENCE
TYPE BT150
Temperature
Regulator

Spence

**SPENCE ENGINEERING COMPANY, INC.**
**WALDEN, NEW YORK**

08-133

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## *"If our executives did not read BUSINESS PUBLICATIONS I'd consider them unfit for their jobs"*

*Col. Willard F. Rockwell,*
Chairman of the Board,
Rockwell Manufacturing Company

"We feel the same way about our sales managers," Colonel Rockwell continues. "We expect them to know what is being printed in the business publications and to guide themselves accordingly. Further, we ask our salesmen to keep our home office informed about the comments of our customers on business periodicals."

Like Colonel Rockwell, other business and professional leaders the country over are reading business publications covering their fields of activity. They are getting from these magazines vital information about new products, new methods, new marketing trends, price and distribution changes through the advertising as well as the editorial pages. The Business Press offers a direct route to anyone who has anything to sell to business and professional men.

NBP

*For a United Business Press*

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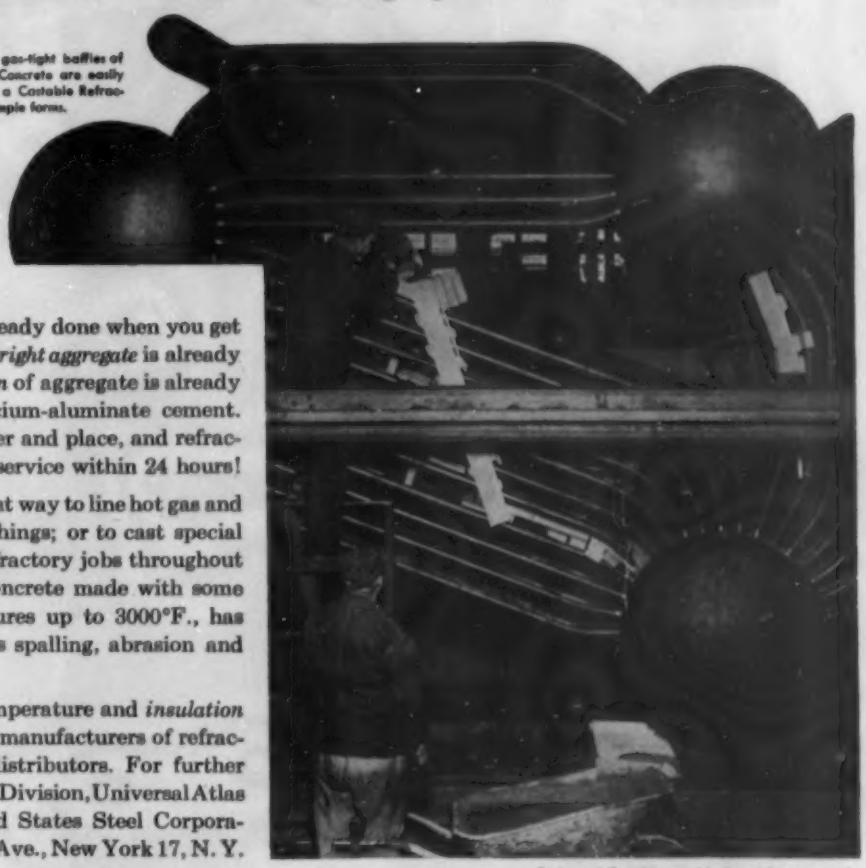
*The national association of publishers of 161 technical, professional, scientific, industrial, merchandising and marketing magazines, having a combined circulation of 3,524,478 ... audited by either the Audit Bureau of Circulations or Controlled Circulation Audit, Inc.... serving and promoting the Business Press of America... bringing thousands of pages of specialized know-how and advertising to the men who make decisions in the businesses, industries, sciences and professions ... pinpointing your audience in the market of your choice. Write for complete list of NBP publications.*

# CASTABLES give you a head start on your next Refractory job

Monolithic, gas-tight baffles of Refractory Concrete are easily made with a Castable Refractory and simple forms.

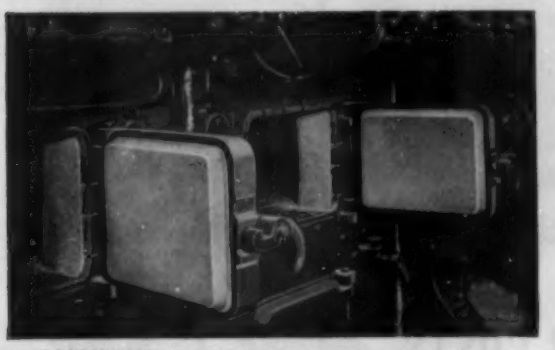


**TWO PARTS OF THE JOB** are already done when you get Castable Refractories. The *right aggregate* is already selected. The *right gradation* of aggregate is already mixed with Lumnite* calcium-aluminate cement. All you do is mix with water and place, and refractory concrete is ready for service within 24 hours!

That's the fast, convenient way to line hot gas and air ducts, stacks and breechings; or to cast special shapes... and do many refractory jobs throughout your plant. Refractory Concrete made with some Castables takes temperatures up to 3000°F., has low volume change, resists spalling, abrasion and corrosion.

**CASTABLES** to meet specific temperature and *insulation* requirements are made by manufacturers of refractories and sold by their distributors. For further information, write Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Ave., New York 17, N. Y.

Packaged Castables used in these jobs were made by Mexico Refractories Company, Mexico, Mo.



**DOOR LININGS** made with adaptable Castable Refractory Concrete. Unnecessary to stock large inventories of special shapes. Instead, special shapes can be cast in place or poured in molds as needed. Volume change is negligible.

**TUBE PROTECTING** Water Wall Studding made with a Castable Refractory is tough and highly radiant, uses a different aggregate than baffles (above). With Castables you get Refractory Concrete tailor-made for the job.

*"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.

IP-L-55R

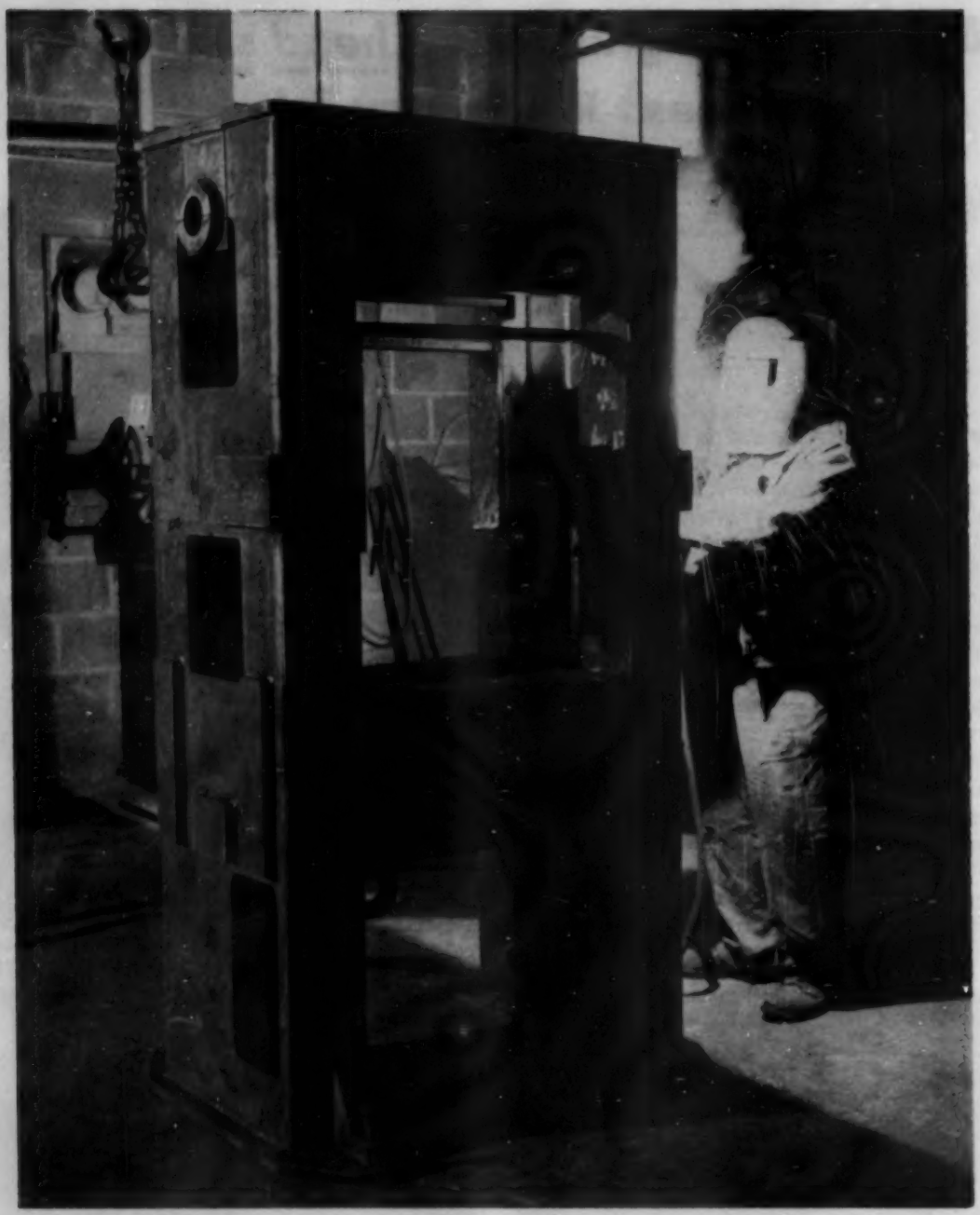
ATLAS® LUMNITE for INDUSTRIAL CONCRETES

REFRACTORY, INSULATING, OVERNIGHT, CORROSION-RESISTANT

A UNIVERSAL ATLAS PRODUCT

UNITED STATES STEEL HOUR—Televised alternate weeks—See your newspaper for time and station.

Circle 535 on Reply Card for more data



# BETTER PRODUCTS AT LOWER COSTS - *by fabrication*

Photo above is all-steel punch press frame. Tho a third lighter than expensive castings it replaced, greater strength and rigidity of welded construction enable punch press to operate 50% faster.

Besides basic saving of material, plus values are reduced freight and handling costs, easier machining qualities. And future design changes can be made at nominal cost.

Because steel can be formed or cut into almost any size, shape or thickness, doubtless some of your own castings can be replaced by fabricated steel, at really worth-while savings.

Send us a print or a sketch of your product. Or if you wish our engineer will call on you. No obligation in either case.

THE FOSTER COMPANY, Saint Joseph, Mich.

Circle 536 on Reply Card for more data

# Oriole...

## ...now a "big league" name in BASEBALL as well as COAL!

Good luck to the Baltimore Orioles Baseball Team! We hope they'll make the name ORIOLE as famous in the American League as it is in the industrial coal league!

Bell & Zoller's *Superwashed* ORIOLE coal is a top performer when it comes to keeping boiler efficiency up—steam costs down—in plants all over the Middle West. This free-burning, low ash, low-moisture coal—scientifically-cleaned and correctly-sized to meet *your* exact specifications—can be shipped from the No. 11 seam in Western Kentucky via rail or economical combined rail and inland waterways.

**BELL & ZOLLER COAL COMPANY**

BELL BUILDING, 307 N. MICHIGAN AVENUE, CHICAGO 1, ILLINOIS

*CLEVELAND · NEW YORK · ST. LOUIS · MINNEAPOLIS · OMAHA*
*MILWAUKEE · LOUISVILLE · TERRE HAUTE*

*Sixty-Eight Years of Service to Coal Users*

**Producers of**
**ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, and BUCKHORN Coals**

*Sales Agents for*
Otter-Creek-Eagle Coal Co.
Lockwood, West Virginia
Spring Hill Mining Company
Terre Haute, Indiana
Boone County Coal Corporation
Sharples, West Virginia

Circle 537 on Reply Card for more data

# which impulse for you?

## STANDARD

The standard YARWAY Impulse Steam Trap serves all normal trapping requirements. Factory set to operate without adjustment at all pressures from 20 psi to 400 psi (Series 60) and 600 psi (Series 120). For pressures below 20 psi, merely remove split washer.

*Numerous advantages like:*

small size
quick heating
steady temperatures
stainless steel construction
one moving part
non-freezing
low cost

More than 900,000 used throughout industry.

Write for YARWAY Bulletin T-1740.

## HIGH PRESSURE, INTEGRAL STRAINER

YARWAY Integral Strainer High Pressure Impulse Steam Traps operate on some of the highest pressure steam lines in the country. Same operating principle as the standard YARWAY Impulse Trap. Strainer built into trap.

Ample capacity when system is being "warmed up"—yet will handle relatively small amounts of high temperature condensate without losing prime. Six sizes—½" to 2". Pressures to 1500 psi (flanged ends) or 2500 psi (welding ends).

Write for YARWAY Bulletin T-1740.

**YARNALL-WARING COMPANY**
100 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY

# impulse steam traps

*YARWAY Impulse Steam Traps and Fine Screen Strainers are stocked and sold by more than 250 convenient local distributors. Write for name of one nearest you.*

Circle 538 on Reply Card for more data

Carrier's firemen learn how to handle various types of fire fighting equipment during realistic practice demonstrations.

# All-Out Fire Protection at Carrier

**FRANCIS E. FEENEY**
**Plant Protection Chief**
**Carrier Corp.**

THE ACTIVE BACKING of top management, coupled with adequate budgets and responsible administration, has helped to develop an efficient fire safety program for Carrier Corporation's $19 million worth of production equipment and plants at Syracuse, N. Y.

During the past decade, there have been no major fire losses—and for the last five years, the average annual loss amounted to only a few thousand dollars. Most significant is the fact that the number of fires reported annually during this period have steadily declined, with only twenty-nine reported in 1953.

Carrier maintains two large operating areas at Syracuse. The Geddes Street Plant is located on a 30-acre tract within the city limits. Its five major buildings, the tallest of which is seven floors, contain over a million square feet. All the structures are of steel reinforced concrete construction. Floors are subdivided into smaller areas by fire walls with self-closing, fusible link doors.

The buildings at this location are 100 percent sprinkler protected, water being supplied from city mains at 96 psi. In addition, a 90,000-gallon underground reservoir is available for emergency use. A steam and an electric booster pump can each feed 1000 gallons per minute to the fire lines if necessary.

Three types of sprinkler systems are found at Geddes Street. Deluge is used in paint storage areas; a dry system on open loading and receiving platforms; while normal wet systems are provided for all other spaces. Depending on the operation and the hazard, sprinkler heads are set to open at temperatures ranging from 165 to 360 degrees F.

Inside hose racks, connected to the wet sprinkler lines, are available throughout all five buildings. Each is equipped with 100 feet of 1½-in. hose and fitted with a nozzle. Five outside hose houses are strategically placed throughout the Geddes property. Each has 300 feet of 2½-in. hose, spray and straight stream nozzles, and necessary wrenches and tools for connecting them.

### Thompson Street Plant

This plant is located outside the city limits, about seven miles from the heart of town, and is the larger and more modern of the two manufacturing units. Two-thirds of the

**Should fire flash, temperature rate of rise fire detectors, mounted in the flo-coat paint machine, automatically trip five 50-pound cylinders of $CO_2$.**

**A carbon-dioxide portable is being charged and weighed while the Fire Inspector notes pertinent data on the unit's recharge card.**

150-acre tract is developed and contains four major buildings and fourteen auxiliary structures. Their combined floor space totals over 1½ million square feet. Here again, steel and concrete construction predominate, but unlike Geddes Street, most of the major buildings are only one story high.

The structures are 95-percent sprinkler protected. The remaining 5 percent are considered to be hazard free. Two 60,000-gallon gravity tanks provide a constant water pressure of 60 psi for the fire line system. A small centrifugal pump operates constantly to boost line pressure to 80 psi and to maintain a full level in the gravity tanks.

Complementing this supply is a million gallon underground reservoir. Three auxiliary booster pumps, each one of which can pump at the rate of 1500 gallons per minute, are available in the power house.

Most of the plant has automatic wet sprinkler systems. Dry pipe systems protect the large inside storage areas which are subject to freezing temperatures. Anti-freeze glycerine systems are used for special hazards that are located outside.

Thirty hose houses dot the Thompson Street grounds and interior hose reels are strategically placed within the buildings.

### Portable Extinguishers

Carrier has adopted a quick visual method of identifying the location of fire extinguishing equipment by painting two 2-in. red bands, spaced about a foot apart, at a fifteen foot height. From almost any location on any floor, several such wall or column markers are visible.

A periodic check of every portable extinguisher is part of the service program. Mimeographed rosters list every unit that is available, its location, and similar pertinent information. Following this list, each portable is checked once a week, its condition noted, and recharge card inspected. When necessary, extinguishers are sent to the Thompson Street Fire Department Headquarters for repair or recharging.

Working under the Plant Protection Chief and a Fire Marshall, a staff of plant Fire Inspectors concern themselves exclusively with the job of fire safety. At Thompson Street, for example, the Inspector makes a daily tour of the plant

searching for conditions which he feels may constitute a fire hazard. It is his duty to make the weekly check of fire extinguishers and to inspect, test, and report on sprinkler control valves. Company regulations state that only a uniformed member of the Fire Department can operate sprinkler valves or controls.

### Permits Issued

Inspectors are responsible for any flame cutting or welding and must issue written permits before such work can proceed. Prior to the issuance of a permit, he inspects the area and sees that all hazardous conditions are eliminated. When satisfied that the risks have been reduced to a minimum, the permit is issued. The Inspector posts a fire watch while the welding or flame cutting is being done and sees that portable extinguishing equipment is handy, fire resistant tarpaulin covers are available, and other necessary precautions are taken. During 1953, 4,487 such permits were issued.

Monthly reports of unsatisfactory fire safety conditions are noted and prepared by the Inspectors. The hazard is described, its location indicated, the responsible individual identified, and the length of time that the hazard has remained uncorrected is stated. If the same hazard is repeated in three successive reports, the Director of Protection and Security takes the matter up directly with management personnel responsible for that plant area. Meanwhile, the report itself is distributed to top management directly.

**The company's fire truck, always held ready to respond to every fire alarm, undergoes a routine inspection by the author (right) and the Fire Marshall.**

Carrier has actively promoted a thorough program of volunteer fire brigade training. While the Plant Protection Chief supervises this program, actual instruction is delegated to the Fire Marshall aided by the Fire Inspectors.

During production shifts, fire brigades consist of a Brigade Chief, four Captains, and thirty Firemen. On night shifts, only a Brigade Chief, three Captains, and fifteen Firemen are necessary.

Care is taken to include supervisory personnel in each brigade along with other plant workers. Members are selected so that firemen are scattered throughout the entire plant. In this manner, several firemen are immediately available in any section of the factory to take initial action in the event of an emergency and prior to the arrival of the full brigade.

Brigades meet monthly for training on company time. The hour long sessions may be devoted to fire prevention or fire fighting lectures, explanation of new equipment, a plant tour pointing out safety apparatus or operations considered to be particularly hazardous, or a practical fire fighting demonstration employing portable extinguishers or hoses.

Practical fire fighting demonstrations are essential; a man who has handled fire fighting equipment and actually has extinguished fires with it, will act effectively and with confidence when confronted with a factory fire. At least one fire demonstration is held annually for supervisory employees and brigade members to emphasize these methods.

**The Fire Marshall explains the operation of a dry chemical portable extinguisher to fire brigade members at one of their monthly one-hour meetings.**

### Fire Alarm Systems

At the fire signal, triggered from any one of 43 alarm boxes, brigade members and Fire Department personnel head for the "in trouble" spot together with key maintenance personnel. Simultaneously, booster fire pumps are thrown into operation. If necessary, the municipal fire department can be called either from the telephones or from alarm boxes.

The company fire truck, housed at the Thompson Street Plant, responds to every alarm. It carries a 200 gallon booster tank and is capable of producing a line pressure of 130 pounds. The truck is equipped

with 1,000 feet of 1½-in. hose, 1,000 feet of 2½-in. hose, a 2½-in. deck gun with a Siamese connection and check valve, flood lights, foam generators, portable extinguishers, and other appropriate equipment. A high frequency radio communication set is available for use between the fire house, fire truck, other vehicles.

### Special Hazards

Hazardous production operations are protected by special apparatus. At the Thompson Street Plant, a flo-coat machine paints a multitude of parts with a mixture consisting of four parts synthetic baking enamel and one part thinner, a highly combustible mixture. Traveling on an overhead conveyor, the parts pass through the flo-coater, enter an enclosed drain area, and are baked in a roof-top oven at 335 degrees F for 23 minutes. Operation of the machine is semi-automatic.

Every effort is made to make the painting areas as safe as possible. The machine itself is cleaned daily and thoroughly washed each month. Ventilation removes the vapors as quickly as they develop. All the equipment is grounded and explosion-proof fixtures are used.

Even with these precautions, it was recognized that when oxygen and a flammable liquid are present, all that is needed to turn the orderly painting process into an inferno is an ignition source. The problem was turned over to the Walter Kidde & Co., whose engineers designed and installed an automatic carbon-dioxide fire extinguishing system.

Should fire flash, temperature-rate-of-rise fire detectors, mounted in the machine, immediately trip 5, 50-pound cylinders of carbon-dioxide gas. Under its own pressure, the gas passes through piping to the machine, where it is discharged from multijet nozzles flanged into the housings of the flo-coat chamber and the drain tunnel. The inert gas reduces oxygen to a point insufficient to support combustion.

Pressure operated switches are built into the system and are actuated by the passage of gas through the piping. In case of fire, they cause the power for the machine and the paint pumps to be secured, shut off ventilation equipment, and sound an audible alarm. It is interesting to note that Carrier adapted this equipment so that if the flo-coater's forced draft ventilation system fails (no fire involved), the machine also stops and the alarm sounds.

Housed in the same wire cage enclosure containing the basic carbon dioxide cylinders, is a reserve set of cylinders. Either the primary or the reserve charge can be manually actuated by means of pull boxes mounted on the enclosure.

### Added Feature

A feature of carbon-dioxide that is particularly desirable, is that in addition to its excellent fire smothering characteristics, being an inert gas, it cannot damage the machine, work-in-process, or electrical equipment. Furthermore, since it eventually is absorbed into the atmosphere following discharge, it leaves no mess to be cleaned up.

---

# Top Honors for Efficiency go to Diesel Power Plant

THE WOLVERINE Electric Cooperative's Johnson Plant at Hersey, Michigan, has been acclaimed —for the second successive year— as the most efficient REA internal combustion generating station.

The Johnson plant serves as the base load station for the five station Wolverine system. In 1953, this one plant recorded a net generation of almost 40 million kw-hrs, more than 78 percent of the five-plant total.

### Units Installed

The original installation consisted of three supercharged, four-cycle Cooper-Bessemer diesels; two 1,010 hp, 400 rpm units installed in 1946 and operated as dual-fuel engines since 1948, and a 1,650 hp, 327 rpm dual-fuel unit installed in 1949. Three identical Fairbanks-Morse, two-cycle, dual-fuel engines, each rated at 3,500 hp at 277 rpm, went on the line in 1951-52.

There are a number of reasons why the Johnson plant was able to show a production expense of 5.29 mills per kwh and overhead costs of 3.32 mills per kwh for a total production cost of 8.61 mills per kwh.

Constant attention is given to engine load factor. The three 3,500 hp units serve as base load prime movers for the entire system operating at an average load factor of about 73 percent. Other plants in the system and the three smaller units at Hersey are used to handle peaks and to pick up partial loads for the big engines.

It is interesting to note that the operators have been able to maintain a good average load factor on the three small engines in spite of their use for peaking and picking up load. In 1953, the three small units operated at average load factors ranging from 68 to 73 percent.

### Partial Loads

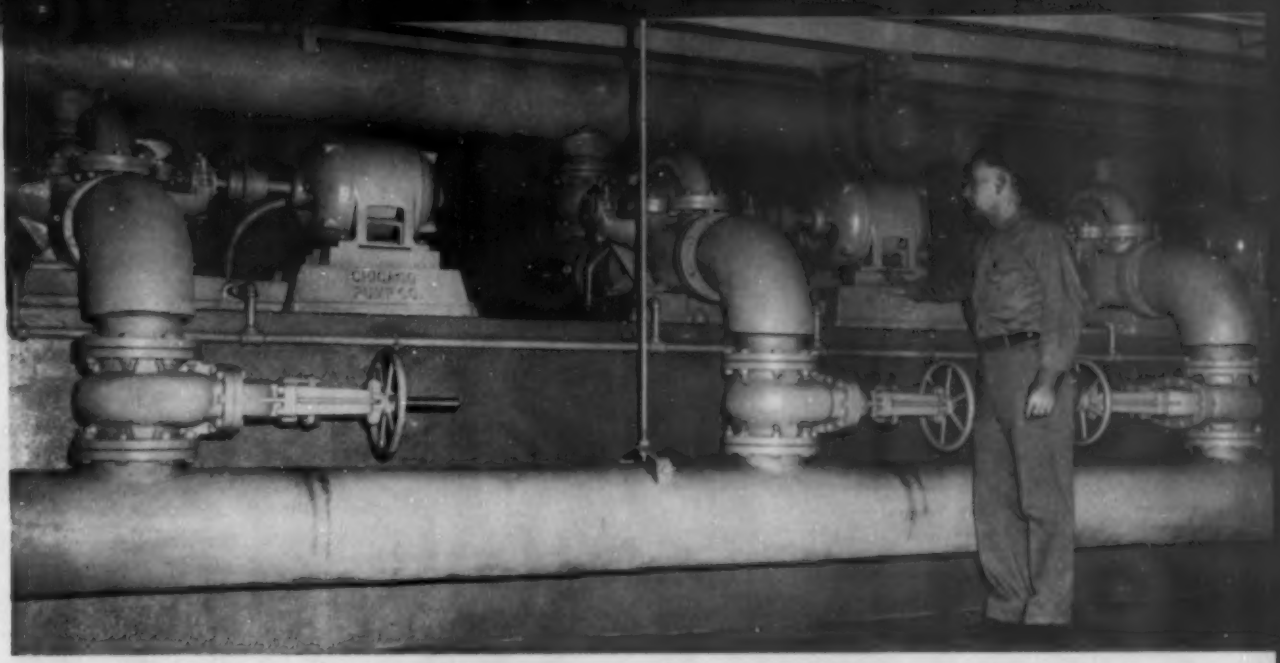
Another factor which has helped promote economy is the ability of all engines in the plant to operate efficiently at partial loads. In recent tests, the three big two-cycle dual-fuel engines showed a relatively flat fuel consumption curve at loads from 50 to 110 percent.

Care in fuel handling and maintenance of fuel injection equipment also has an important effect on operating economy. For pilot oil, the plant uses a blend of 70 percent gas oil and 30 percent No. 3 diesel fuel, combined at the refinery. The oil is thoroughly filtered between storage and day tanks.

The plant has a closed room equipped with nozzle tester and precision-type centerless grinder for maintenance of nozzles and injection pumps. Nozzles are replaced immediately if fuel consumption rises. Every 30 days, as a matter of routine preventive maintenance, all nozzles are tested and cleaned. Those that require it are dismantled for grinding and hand-lapping of the needle valve.

### Intercoolers

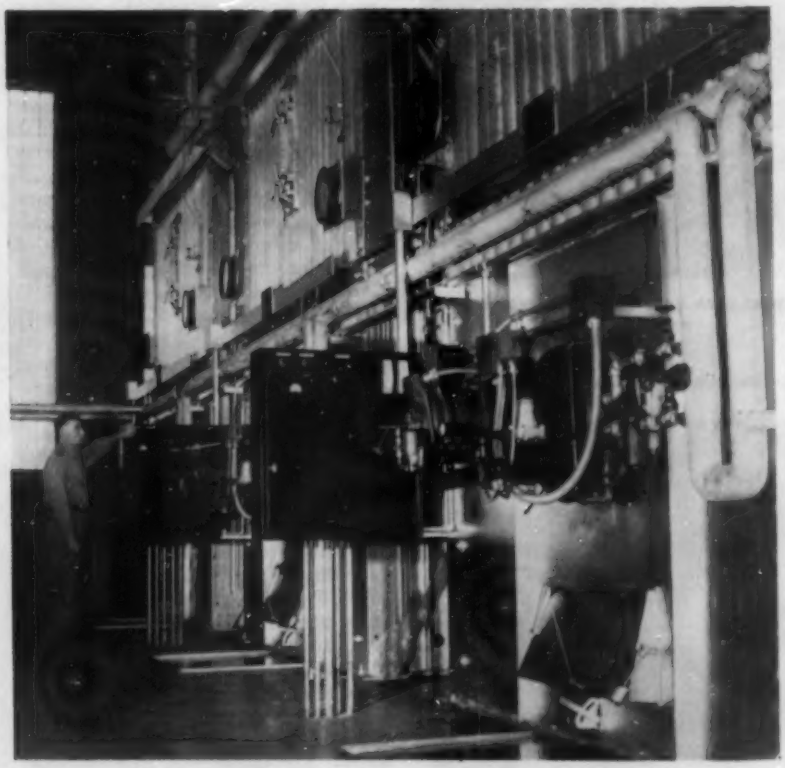
Initial experience with intercoolers on the three two-cycle F-M engines indicates an improvement in engine efficiency. By insuring an adequate supply of engine air, the intercoolers make certain that the big dual-fuel units can handle full loads and overloads in the hottest summer weather. This allows the operators greater flexibility and results in better load factors.



Three pumps circulate hot water through the heating system. Two units carry normal loads; the third serves as a standby.

# Parma's "Perfect" Heating System

WALTER RUDOLPH

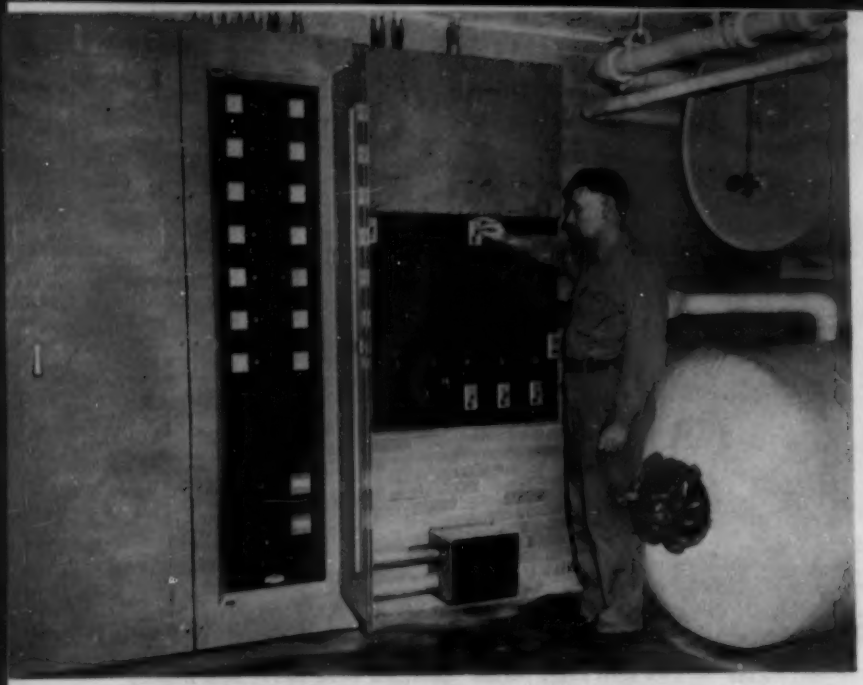


At present the three, 250-hp, two drum, water tube boilers operate on No. 6 oil.

CULMINATING FOUR YEARS of planning and construction, the ultramodern $5,000,000 Parma Senior High School at Parma, Ohio (near Cleveland) opened in September 1953 for a normal capacity enrollment of approximately 1500 students. More could be accommodated if necessary. While much national recognition has been given to the comprehensive details embodied for high school education, the "boiler room", as it is called at the school, is exemplary in its own right.

## Heating System

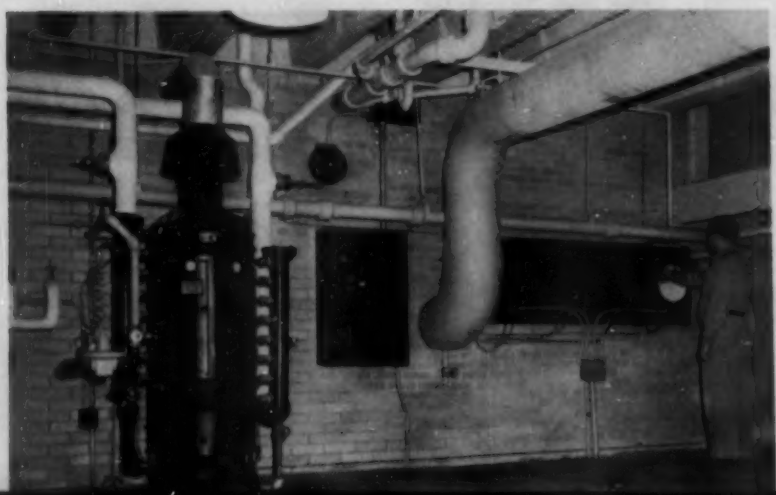
Heating is an important problem at a project of this magnitude. There are several hundred rooms, ranging in size from a hundred square feet or so, to large areas like gymnasiums and auditoriums that not only encompass thousands of square feet of floor space, but have high ceilings. A hot water heating system was chosen, and convector units were installed in classrooms and other small areas. For sections of the building where crowds congregate, large blower type cooling and heating units were selected. Hot water for all units is circulated by three, 10-hp pumps mounted on a concrete shelf in the boiler room. Two of



Conveniently located panels permit individual control of each heating zone.

Mechanical draft fans are mounted on top of each boiler near the rear wall.

The water heater, fire alarm panel, and recording instruments are shown below.



these pumps supply normal requirements while the third is a standby.

The core of the heating system is a battery of three, oil fired, two drum, water tube boilers. Each unit contains 2575 sq ft of heating surface and has a continuous duty rating of 250 hp at a design pressure of 160 psig. These boilers were assembled on the job in a boiler room roughly 100-ft long, 75-ft wide, and two stories high, attached to the main building. Gas firing equipment also is slated for installation, possibly in the near future.

## Fuel Supply

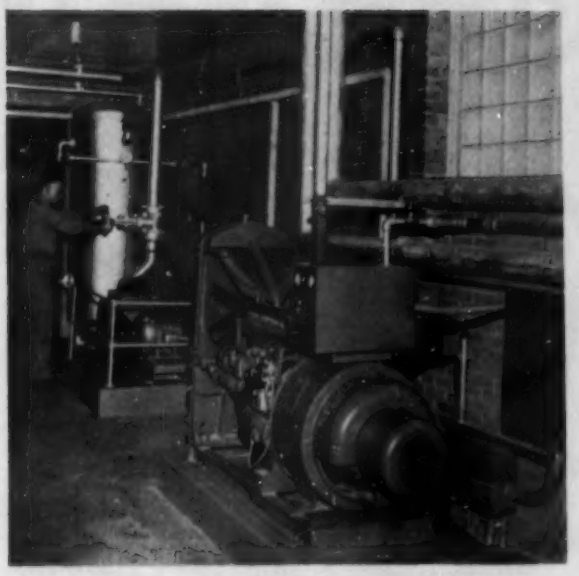
At present, the plant operates on No. 6 oil, with consumption averaging approximately 1000 gallons every 24 or 25 hours. This fuel is stored in two underground tanks near the boiler room, each of which holds 30,000 gallons. Both tanks are equipped with individual heating coils, and when oil enters the boiler room it is pumped through a continuously circulating and heating unit, which is designed to bring the oil to 110 F before it is fired. The oil preheaters use hot circulating water that comes from a single, domestic size, oil fired boiler located beside the inside preheating unit in one corner of the boiler room.

In discussing the project, George Rose, heating and ventilating engineer for the school, who has been in the greater Cleveland school systems for a number of years, said "This is the most nearly perfect heating system of all those I have experienced. Although the original installation cost was higher than it would have been for a packaged heating system, we think we're getting greater economy of operation. Of course, operation is fully automatic, too, and requires only myself and one assistant in a day's time."

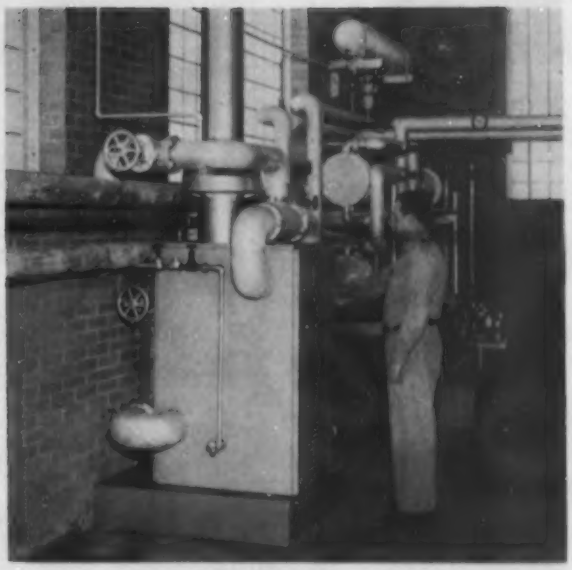
## Controls

Automatic operation of the system is controlled by air powered thermostats, strategically located in 16 heating zones—a natural requirement for a huge structure with many wings. These zones can be regulated from a panel on the wall of a maintenance section in the boiler room. For normal use, temperatures are set at 72 F, but are dropped to 65 F during the night or when a zone is not occupied. The circulating water temperature is maintained at 140 F except in areas such as shower rooms and the cafeteria where boosters are installed to provide the higher temperatures required for showering, dishwashing, and other miscellaneous services.

On an average winter day, all



**Air compressor for control system is at left. Standby generator, right, is one of two emergency power units.**



**Domestic size boiler, foreground, furnishes hot water for both the tank coils and the fuel oil preheaters.**

three boilers are put into operation early in the morning, and one is shut down several hours later. This takes place automatically because the thermostatic controls are coupled with an outdoor thermostat. When the outdoor thermostat registers rising or falling temperature, the inside controls act to counterbalance the weather. Instruments mounted at one end of the boiler room continuously record outside and inside temperatures as well as water flow.

Two air compressors are an important part of the installation. One of these develops 120-psig pressure and is used for periodically blowing the boiler tubes. The other constantly maintains 80-psig pressure in three strategically located storage tanks throughout the building. These tanks serve the thermostatic control equipment, pressure being reduced from 80 to 15 and 30 psig as required by individual components.

It is interesting to note that a change in the physical structure of the boiler room was required soon after the heating system was placed in operation. An individual, 7-hp induced draft fan is mounted above and behind each boiler. With only one boiler on the line, performance met expectations, but when two units were operated together, the system began to show inefficiency. Placing the third boiler in service then proved conclusively that the air input to the room was insufficient to meet the combined requirements of all three units. Consequently, a vaned air inlet was substituted for a glass block panel in one end of the boiler room to assure adequate combustion air supply.

## Safety Facilities

Safety equipment at the school includes two standby electric generating units, one in the boiler room and one at the other end of the huge building. These units supply 110 volt current for emergency lighting in halls and classrooms. In addition, the school's fire alarm system control panel is in the boiler room. When students or teachers turn in an alarm in any part of the building, the boilers are immediately shut down as a precautionary measure.

George Rose and his assistant, Carmen Bevacqun, who comes to work at noon, have simple but modern office quarters located at second story height at one end of the boiler room, with glass sash overlooking the entire installation. Desks, lockers, filing equipment, and other necessary facilities all are available. Adjoining the office is a 20 ft by 25 ft maintenance shop for minor repair work that also contains three, heating system expansion tanks and a storage tank for the hot water supplied to school washrooms. The hot water heater is just below the storage tank, on the first floor of the boiler room.

**PRINCIPAL EQUIPMENT**

| | |
|---|---|
| Boilers for heating system | The Babcock & Wilcox Co. |
| Mechanical draft fans | Prat-Daniel Corp. |
| Oil burners | Ray Oil Burner Co. |
| Oil burner controls | Great Lakes Equipment Co. |
| Oil pumps | Brown & Sharpe Mfg. Co. |
| Oil pump motors | The Master Electric Co. |
| Oil preheaters | Water Tube Boiler & Tank Co. |
| Boiler for oil preheaters | Bryant Heater Division |
| Classroom convectors | Herman Nelson Division |
| Large blower units | B. F. Sturtevant Division |
| Water circulating pumps | Chicago Pump Co. |
| Water circulator, preheaters | Bell & Gossett Co. |
| Thermostatic control equipment | Johnson Service Co. |
| Heating zone panels | Frank Adam Electric Co. |
| Switches on zoning controls | Allen-Bradley Co. |
| Recording panel | Minneapolis-Honeywell Regulator Co. |
| Air compressors | Ingersoll-Rand Co. |
| Standby generators | Power Plants, Inc. |
| Fire alarm system | Autocall Co. |
| Water heater for washrooms | Ruud Manufacturing Co. |

Getting inside the spray section of an air washer and hosing down baffle plates is a periodic maintenance function.

## If Your Air-Conditioning Has Been Hibernating

# Get Ready for Summer

W. R. EVANS, JR. and R. B. HAMILTON
Celanese Corp. of America

TO THE PEOPLE responsible for operation and maintenance of industrial air-conditioning, spring means preparation for efficient, uninterrupted service throughout the summer months. Perhaps the hardest part of this task is to predict the minimum amount of maintenance necessary to prevent an untimely shutdown during the summer. In our experience, a running record of past operating data provides the simplest and most accurate basis upon which sound engineering decisions can be made.

*Reciprocating Machines*—An internal inspection of a reciprocating machine should be made every three years. The suction and discharge valves and discs are the parts that are most likely to give trouble. If allowed to operate too long without being checked, they can cause extensive damage to the pistons, cylinder walls, and other parts.

An annual external inspection is essential. Any refrigerant leaks that are found (using a leak detector) should be repaired and the necessary amount of refrigerant added to the system. If the entire charge has been lost, it is advisable to purge the system and evacuate it completely to a 37 degree wet bulb reading before recharging. This insures against moisture or air contamination.

Couplings, flat belts, or V-belts must be replaced if badly worn. In ordering new belts, specify matched sets of V-belts, since each belt size actually comes in several lengths, the total variation being almost an inch difference in some instances.

Check and operate automatic and manual controls each spring. Controls which are not actuated normally—such as high and low pressure cut-outs—can become frozen or corroded if they are not periodically operated and reset.

Unloaders allow a reciprocating machine to operate economically at almost any load. Since they generally work by oil pressure, it is a simple matter to check for trouble. The extent of annual maintenance depends mainly upon the type of unloaders installed.

A brush forced through the evaporator or condenser tubes by air or water pressure is a fast and effective method of cleaning. When water is used, it provides at the same time a flushing action to get rid of the scale removed by the brush. Frequency of cleaning depends upon the quality and hardness of the water used

in the air-conditioning system.

Contaminants picked up by the oil during a season's operation will reduce its quality and efficiency, making an annual change advisable. The new anti-foaming oils seem to offer some additional protection against rapid deterioration of the lubricant.

*Centrifugal Machines*—Centrifugal machines should be given a thorough internal inspection every five years. The main bearing tolerances, as well as other spots where clearance is important, should be checked with feeler gauges. If considerable wear has taken place and extensive repairs are in order, an overhaul should be supervised by a factory trained serviceman.

Both the rotating and the stationary shaft seal faces should be observed every year. If either appears scored, it should be lapped or replaced. With proper maintenance, shaft seals will last many years.

During the internal inspection, the lubricating oil pump, drive, gears, and the spring loaded pressure regulating valve are checked for proper operation. Parts showing any wear can be replaced.

No machine should be opened up for internal inspection unless gaskets and the parts most likely to be worn are available for installation. It is important that parts be replaced and the machine be closed up as soon as possible. A machine lying open waiting for replacement parts is inviting trouble from dust, corrosion, and moisture.

The external inspection of a centrifugal differs very little from that of a reciprocating machine. The visual and leak detector tests are the same except that a pressure must be built up in a centrifugal whereas a reciprocating machine is always under pressure.

All leaks can and must be stopped as quickly as possible. Even a slight leak will allow hundreds of dollars worth of refrigerant to escape in a matter of weeks. Sometimes it is possible for the refrigerant to leak through the porous compressor casting. A good coat of sealing paint can often be used with noticeable success. This should be applied while the machine is under a vacuum so that the paint is sucked into the pores where it can form a seal.

Operation of purge units, found on virtually all centrifugal machines, should be frequently checked. The corrosive action of the refrigerant, moisture, and non-condensable gas mixture, seems to cause damage.

Most centrifugals use a Fast's or similar type coupling on the main drive shaft. Oil is generally specified as the coupling lubricant. If the oil leaks or is thrown out, the best thing to do is to switch to grease. Only a light weight, high grade grease, that will not harden, should be used.

Changing or cleaning filters is a never-ending job. The cooling season should always be started with clean filters. A practice that is often used, and highly recommended, is to remove all the filters and clean the entire filter chamber with a vacuum cleaner. New or cleaned filters are then installed and masking tape applied to seal up any cracks that may be revealed around the filters.

While the vacuum cleaner is available, it is advisable to clean off the coils. Bits of trash and dust have a way of finding an entry into the system, and a surprisingly small amount of foreign matter can greatly reduce the air flow and heat transfer.

A year or two of operation is often enough to require a new coat of paint on the fan blades and housing. The corrosive effects of the high moisture content of the air leaving

**An essential part of the annual inspection is checking for refrigerant leaks. The maintenance man uses a refrigerant leak detector for this work.**

**Here again, a leak detector is effectively used to locate any leaks that may occur in or around the seal of this centrifugal refrigeration compressor.**

This air washer will start the cooling season with clean filters. Changing filters is never-ending job.

Another vital check is the proper alignment of the coupling between the motor and speed increaser gear.

the cooling coils, along with the various industrial fumes and gases picked up by the air intakes, make a thorough inspection of these parts very essential.

### Air Washers

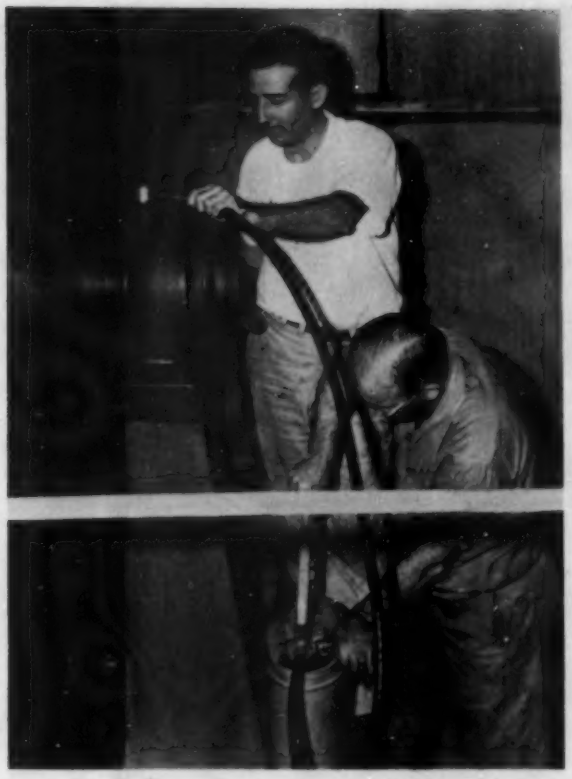
Air washers present a special problem. Keeping the washers clean and free from slime and algae growth is a year-round proposition. It may be advantageous to employ water treatment specialists to assist in solving the algae problem.

When the total solids of the spray water reach a high concentration, some of these solids pass through the moisture eliminators and get into the air distribution system along with the moisture entrained in the supply air. The moisture evaporates, leaving the solids in the duct to be blown out through the air diffusers. Everything possible should be done to keep from adding to this increase in total solids. The authors have found that the use of powdered soda ash or $NaHSO_4$ (Nitre Cake) for controlling pH will add greatly to the buildup of solids. In their place, concentrated alkaline or acid solutions will do a better job while adding practically no solids.

The corrosion of washer baffle and eliminator plates is a problem of prime concern. Stainless steel seems to be the best answer at the present, but the cost is often prohibitive. The next best thing seems to be galvanized iron—although five years is considered to be about the average life for this material in air washer applications in most installations.

The spray section of an air washer must be cleaned periodically. Local conditions will determine the frequency. In all cases, the job should be done as quickly and thoroughly as possible. It has proven helpful if the spray water can be treated with a detergent, heated, and sprayed

A good vacuum cleaner with plenty of hose and "elbow grease" is the best solution for removing dust and dirt that inevitably gets into air ducts.



After bearings at fan inlet were cleaned, they were repacked with a good grade of lithium base grease.

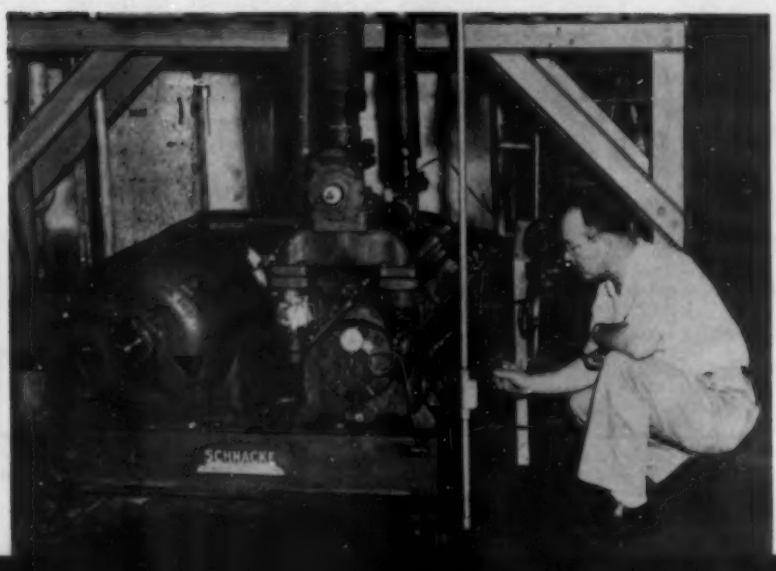
The corrosion of washer baffle and eliminator plates is a problem of prime concern to the maintenance man.

through the regular water sprays. This cleans the piping as well as the interior of the spray section.

Since the dehumidifier pan is continually covered with water, it is difficult to have paint adhere to it for any length of time. Although the spray water may be treated to prevent oxidation, a protective coating of some kind is necessary with ferrous metal pans. One of the best coatings is a roofing tar compound which is heated and applied with mops. A substantial coverage on a well-cleaned metal surface will provide years of trouble free protection.

The water circulating pumps should be disassembled every two years and checked for excessive wear. The bearings are cleaned and regreased with a good grade of lithium base grease. Particular attention is paid to the packing glands and the shaft or shaft sleeves at the packing. If the shaft or sleeves indicate excessive wear, they should be replaced. Wherever possible, mechanical seals should be used instead of packing. Although the original cost is greater, the maintenance and replacement of worn shafts and sleeves will be reduced.

Periodically testing and adjusting safety controls, especially those which are not normally operated, will prevent frozen or corroded contacts.




## Air Distribution Systems

If the air supply ducts were properly designed, it is not a difficult task to maintain the desired air flow. The annual preparation for summer involves, mainly, cleaning procedures. A good vacuum cleaner with plenty of hose is the best solution to removing the dust and dirt that inevitably gets into air ducts.

Grilles and diffuser outlets should be cleaned and painted if necessary. In addition, some adjustments may be necessary as the system changes over from heating to cooling. A slight draft of warm air is not nearly so noticeable as the same draft of cool air.

This chemical proportioning pump injects a solution of aluminum sulfate and sodium aluminate.

# Chrysler Wins Its War on Waste

OPERATING RESULTS provide ample evidence that the modern waste disposal system at Chrysler's Trenton Engine plant is one of the most efficient in Michigan. This system processes production wastes (composed principally of cutting oils, soluble oils, washing solvents, and crankcase oils from the dynamometer test stands) and delivers a clear, innocuous effluent to the sanitary sewers. In fact, residual impurities are appreciably less than the limits imposed by the Wayne County Road Commission's "Specifications for Influents to the Trenton Sewage Disposal System," as indicated by the comparative data listed in Table 1.

## System Design

Examination of the system design readily explains how this optimum performance is achieved. All treatment facilities are consolidated in a brick building adjacent to the boiler plant where operations are supervised and rigid control tests are periodically performed by the boiler plant personnel. The only parts of the system that extend into the manufacturing area are the sewage lines which receive the wastes at their sources. These lines all discharge into a 10,000-gallon influent sump at the disposal plant.

Since the 10,000-gallon influent sump is low enough to permit gravity flow in the sewage lines, two, 300-gpm sump pumps are installed to elevate the wastes to a main, 100,000-gallon holding tank. These pumps are float controlled, being actuated by liquid level in the influ-

**TABLE 1—COMPARISON OF SPECIFIED LIMITS WITH EFFLUENT TEST RESULTS**

| | *Average** | *One Shift Maximum** | *Typical Test Results* |
|---|---|---|---|
| Grease, ppm | 10 | 30 | 3.7 |
| pH | 6.5-9.0 | 10 | 7.01 |
| Suspended solids, ppm | 200 | 400 | 4 |
| Cyanide, ppm | 1 | 1 | None |
| Chlorine demand, ppm | 10 | 15 | 2 |

*Wayne County Road Commission, "Specifications for Influents to Trenton Sewage Disposal Systems".

Herb Stone, chief engineer, is shown at right, drawing processed effluent from a sampling point in the discharge line.

ent sump, and liquids are discharged periodically into the 100,000-gallon tank. This storage space actually is part of the waste disposal building foundation, and it constitutes most of the basement area. The large volumetric capacity provided by this arrangement permits holding the wastes for a sufficient length of time to equalize the pH value and oil content.

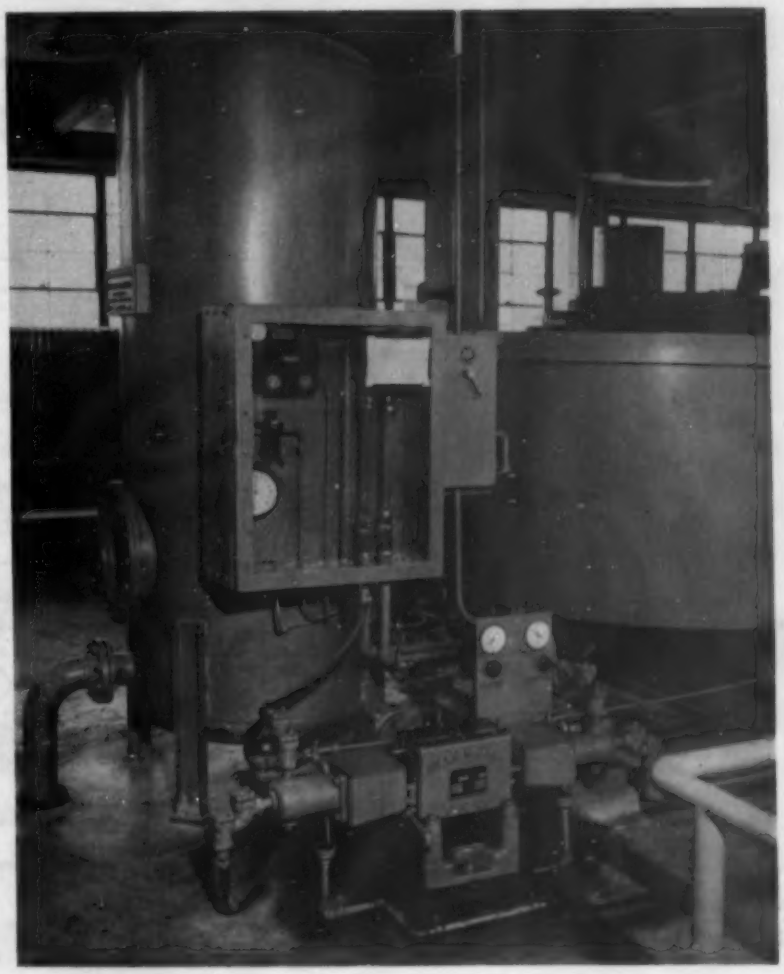
Two, 250-gpm feed pumps are installed at the base of the main holding tank, the liquid level serving as the suction head. Each of these pumps has a suction manifold that contains connections for both chemical feed and air injection. The principal chemical introduced at this point is silicate of soda, to which a small amount of ammonium sulfate has been added. This mixture is stored in two, 750-gallon steel tanks, located on an elevated platform.

Both feed pumps discharge into a common header, which is equipped with an air operated control valve. Flow is controlled from the liquid level in the main holding tank with the discharge passing to a retention tank on the main floor of the building. The purpose of this retention tank is to allow sufficient time for driving the air and silicate of soda into solution.

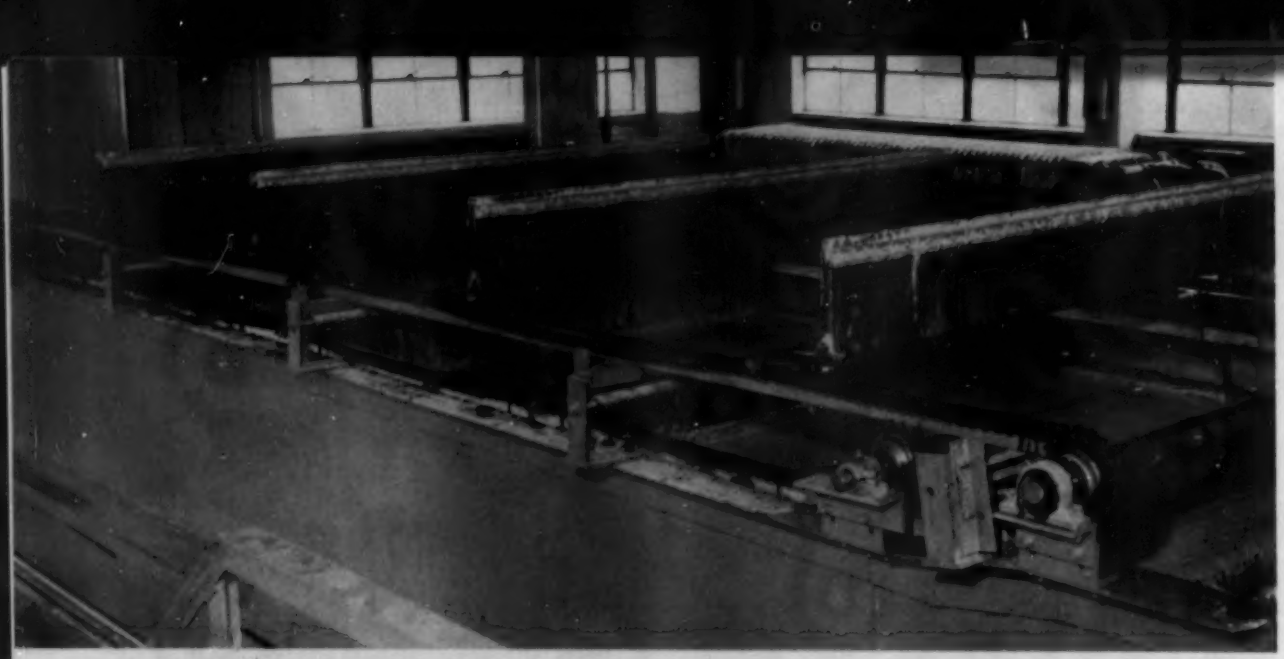
### Retention Tank Control

Pressure on the retention tank is maintained at 35 psig by an air operated control valve located in the discharge line. Then as the wastes leave the retention tank a proportioning pump injects aluminum sulfate to which a measured amount of sodium aluminate has been added to increase the pH value to a predetermined level. The aluminum sulfate —sodium aluminate mix originates in two, 750-gallon, rubber lined tanks, both of which are equipped with air agitators that operate continuously to prevent the chemicals from coming out of solution.

The discharge line from the retention tank passes to a Colloidair separator. This line enters the separator vertically so that the floc formation promoted by the aluminum sulfate injection has full advantage of the rapid air release at this point.



Wastes are held in a retention tank a sufficient length of time to drive the air and silicate of soda into solution.



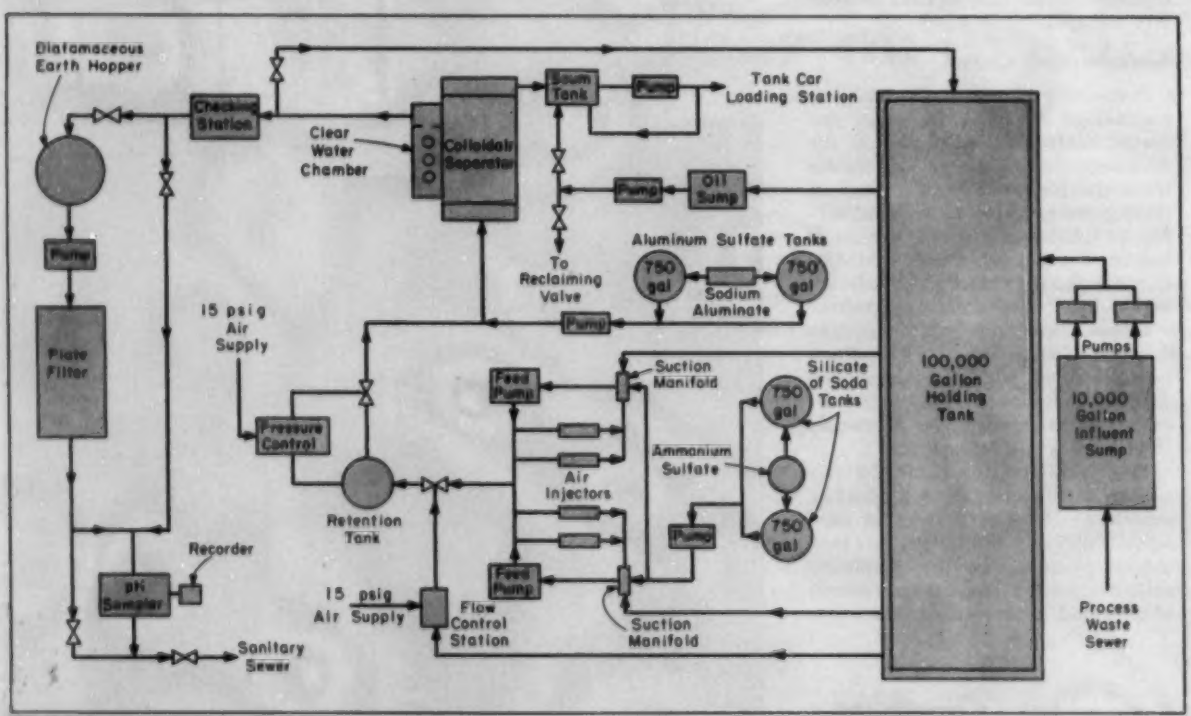
**Flight scrapers continuously traverse the surface and drag the floc to the discharge end of the Colloidair separator.**

The floc rises forcefully to the surface, and as the liquid flow passes over a diffusion plate between the inlet chamber and the main part of the separator, it remains on the surface while clear water drops to the bottom of the separator tank.

Flight scrapers continuously traverse the surface of the separator and slowly move the floc to the discharge end. The scum ultimately passes to a scum tank equipped with a sump pump that transfers the waste to a tank car loading station, while liquid is drawn off and returned to the holding tank. Clear water, meanwhile, drops to three tubes on the bottom of the separator tank. These tubes pass through one of the side walls and then turn and become vertical standpipes in an auxiliary clear water chamber.

### Final Clarification

Clear water spills over the tops of the riser tubes and discharges over a 90 degree weir near one end of the clear water chamber. The effluent then passes through a checking station, and if any irregularities are




**Schematic flow diagram shows the general arrangement of the various components included in the waste disposal system.**

noted the liquid is returned to the main holding tank. Normal flow from the checking station, however, is to a mixer, equipped with liquid level control, where diatomaceous earth is added before the solution is pumped to a frame and plate filter. After passing through the filter, the effluent receives a final pH content test, and the results are recorded.

All parts of the system are very carefully arranged to assure high quality effluent. In fact, the system is so efficient that for some flow rates certain operations can be bypassed. For example, clear water from the separator can be directed to the sanitary sewer if tests indicate there is no need for filtration. Conversely, if observations indicate the necessity, effluent leaving the separator can be returned to the holding tank.

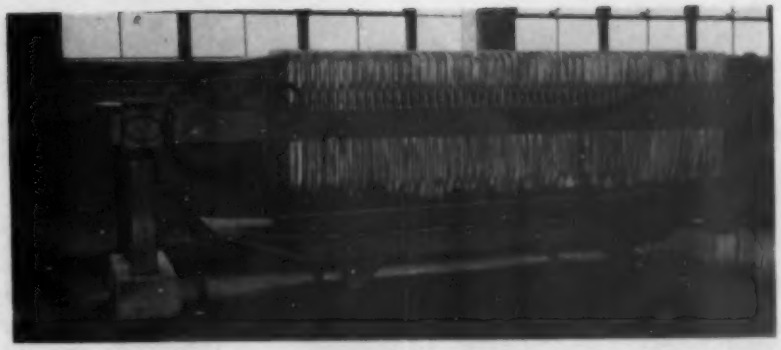
Each individual component is very amply sized. The separator is designed for a flow rate of 400 gpm, while the frame and plate filter can handle 450 gpm. Normal flow rates up to the present time have been considerably under these values, but since all capacities are based on ultimate plant requirements, increased utilization is anticipated.

### Reclaiming Facilities

Another feature of the system is the lengthy retention time in the main holding tank. During this period, oil rises to the surface of the liquid, and arrangements have been provided so it can be skimmed off into a separate oil sump. From this point the oil can be reclaimed or directed to the scum sump which receives the discharge from the Colloidair separator. This latter procedure is used at present, but when flow rates increase to a point where it is desirable, the reclaiming procedures will be placed in operation.

During initial operations the scum represented a relatively small volume and consequently was discharged directly to yard areas surrounding the plant. Chrysler's personnel has done some experimentation with directing the scum to the coal pile and then burning it as a supplement to the normal fuel supply. This, however, was tested only on a limited scale and probably will not be practiced extensively.

Operating results with the system have been extremely satisfactory. Control tests show that oil or grease content is maintained within a range of 3 to 5 ppm. Average total solids content for all flow rates is only 3 ppm. The pH value is carefully controlled, and visual observation indicates effluent clarity is equivalent to drinking water.



**This frame and plate filter is used for final clarification of the effluent.**

**A mixer adds diatomaceous earth before the solution is pumped to the filter.**

**PRINCIPAL EQUIPMENT**

| | |
|---|---|
| Colloidair separator and diatomaceous earth mixer | Bulkley Dunton Pulp Co., Inc. |
| Frame and plate filter | Valley Foundry & Machine Works Inc. |
| Control valves | Mason-Neilan Regulator Co. |
| Feed and filter pumps | Fairbanks, Morse & Co. |
| Holding tank sump pumps | Aurora Pump Co. |
| Scum sump pump | Viking Pump Co. |
| Pump motors | Howell Electric Motors Co. |
| Pump motors | Fairbanks, Morse & Co. |
| Chemical proportioning pump | Hills-McCanna Co. |
| Chemical proportioning pump drive | Vickers, Inc. |
| Effluent pH indicator | Beckman Instruments, Inc. |
| Effluent pH recorder | Minneapolis-Honeywell Regulator Co. |

# Cathodic

**J. H. HIRSHFELD**
**Vice President**
**The Hinchman Corp.**

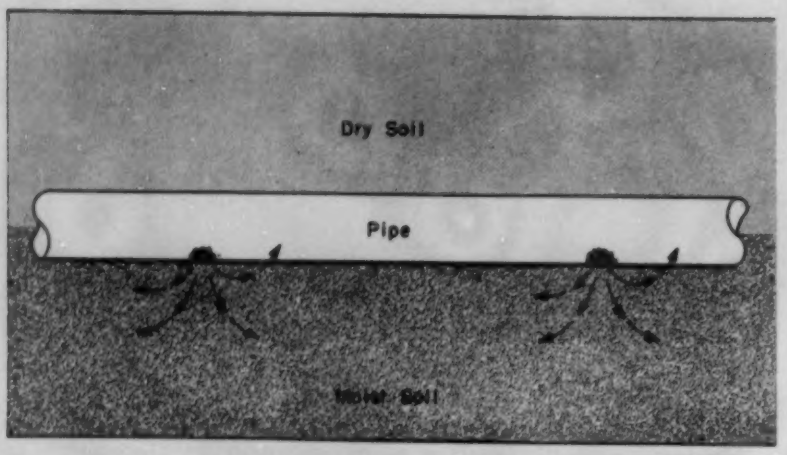



**Fig. 1—Corrosion is basically electrolytic in nature; here a galvanic cell is formed on a pipe through the means of electrolytic action of soil.**

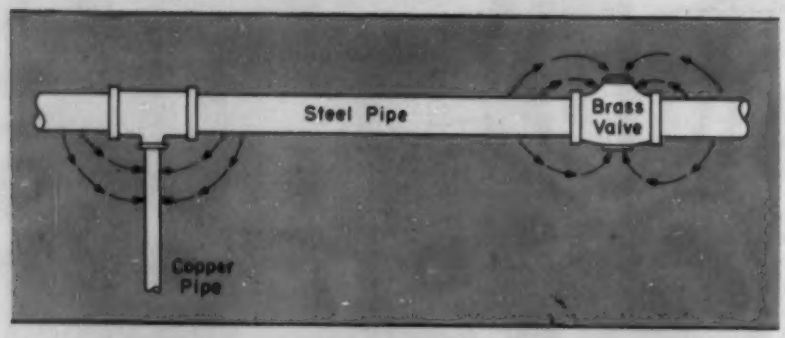



**Fig. 2—When metals of different kinds adjoin in a common electrolyte, they form galvanic cells; corrosion occurs wherever currents leave metals.**

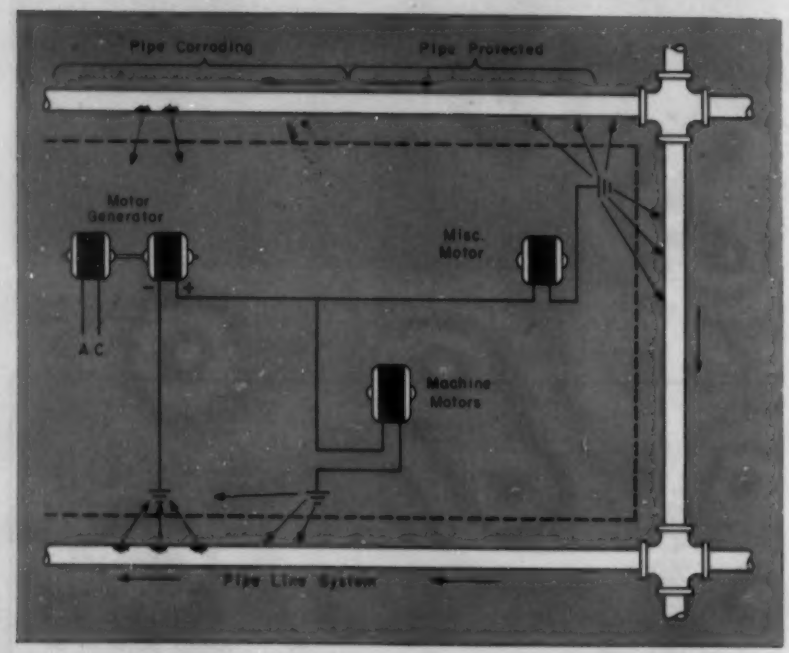



**Fig. 3—In an industrial plant, stray currents may arise between machinery and grounds; where currents leave metals, electrolytic corrosion takes place.**

CATHODIC PROTECTION has received much favorable publicity within the past few years as a highly successful means of preventing corrosion. Its use is fairly well known for long cross-country pipelines, large tank farms, and marine installations; all of these are spectacular but have little relation to the average industrial plant. It is in the industrial plant that some of the largest potentials for future applications of cathodic protection lie.

Corrosion prevention is preventive maintenance. This form of preventive maintenance effects two types of savings for industry. First, it reduces the direct costs of repairing and replacing plant structures. This results in important material and labor savings. Secondly, and of even greater importance, it reduces the indirect losses which result from failures due to corrosion. Some of these indirect losses include loss of production, lost labor charges, losses in emergency shutdown of plant or equipment, or losses created by hazards, injuries, fire, and explosions.

The indirect costs of corrosion in industrial plants are believed by most authorities to be much greater than the direct losses. A cable failure, as one example, may cost only a few hundred dollars to repair but the resultant power shutdown may cost thousands of dollars in lost labor alone. Again, the fire caused by a gas explosion, or resulting from a volatile liquid leaking from a corroded tank, may cause incalculable damage. Because cathodic protection is an effective means of preventing many of these large losses, it has a bright industrial future.

## Corrosion Causes

Cathodic protection is possible because corrosion is electrochemical in nature. Man finds metals in the earth in the form of various oxides and refines them for his uses. However, nature is a great leveler and seeks to turn them back into the oxides and compounds from which they were refined. The resultant corrosion takes place from

# Protection For Industrial Plants

three causes: corrosion from the environment of the metal (Fig. 1), corrosion resulting from the connection of dissimilar metals (Fig. 2), and corrosion resulting from stray electrical direct currents (Fig. 3).

### Currents Flow

The three illustrations show that current is leaving the corroding metal at various points. Wherever it leaves, metal ions are going into solution in the surrounding medium (the electrolyte). Wherever metal ions are going into solution, the metal is corroding. This is an electrochemical process, and corrosion takes place where there is current transfer. The corrosion will occur without regard to the source of the current. It may arise from the soil or water environment, it may occur from connecting two different metals such as steel (corroding) and copper (protected); corrosion can follow from a stray electrical current flowing from a direct-current motor, welder, or plating tank.

If the electric current can be prevented from leaving the metal surface, the electrochemical process can not take place and the corrosion will be halted. One of the most effective ways of preventing the current from leaving the metal is to impose a direct current flowing into the metal; the imposed current must be of sufficient magnitude to suppress the currents tending to leave the metal. This is the essence of cathodic protection.

Cathodic protection may be accomplished in two ways (Fig. 4 and 5). One method is to electrically couple another metal (usually magnesium) with the metal for which cathodic protection is desired. The two dissimilar metals, electrically connected and in an electrolyte, form a galvanic cell or battery. Current will flow through the electroylte from metal higher in the Electromotive Force Series to the other metal. Corrosion will occur on the metal from which current is leaving and will be prevented on the metal to which current is flowing. Corrosion between dissimilar metals is thereby used advantageously; the corroding metal (the anode) is sacrificed to protect the non-corroding metal (the cathode).

### Bucking Currents

The other method of cathodic protection is to impress a current from some external source on the metal to be protected. The most common method is to use a rectifier as the current source and to have the current leave anodes of graphite or scrap steel. Other anode materials have found favor in industry for particular services; aluminum, stainless steel, and platinum are all being used successfully.

The corrosion-causing currents are usually very small, but one ampere of current leaving a steel surface for a year can remove 20 pounds of steel. If the current is leaving a lead surface, one ampere can remove 70 pounds of lead in a year's time. Consequently, it is small wonder that a fraction of an ampere acting over a period of a few years will cause pitting and perforation of pipes and tanks.

### Power Consumption

Because the corrosion currents are small, the required cathodic protection currents are also small and represent negligible power consumption. Current densities of from 1 to 5 milliamperes per square foot of surface will usually protect steel in soil. However, some specialized conditions require much higher current densities. One of these is the case of direct chemical attack on a metal. Here the current density required may be from 25 to 40 milliamperes per square foot. (Hot sulfuric acid on a steel surface, for example, requires 37 milliamperes per square foot for protection of the steel.)

The industrial uses of cathodic protection can be divided into two classes. There are those protecting underground utilities and structures, and those protecting aboveground structures. Typical uses in each category are listed below:

Below-Ground Structures

- Buried communication and power cables
- Communication and power cables in ducts
- Water distribution systems
- Fire protection systems
- Gas distribution systems

*(Continued on next page)*

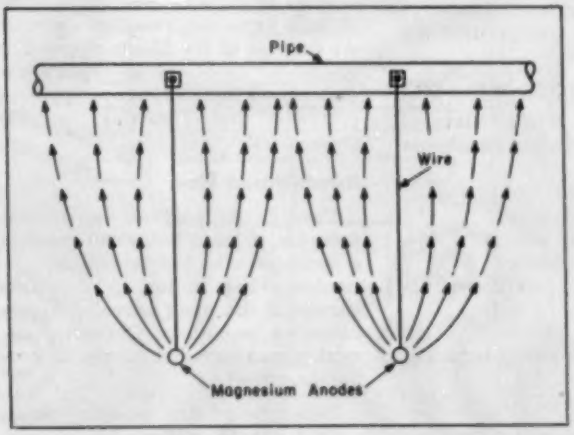



**Fig. 4 — Sacrificial anodes protect equipment by forcing corrosion-producing currents to leave from anodes.**

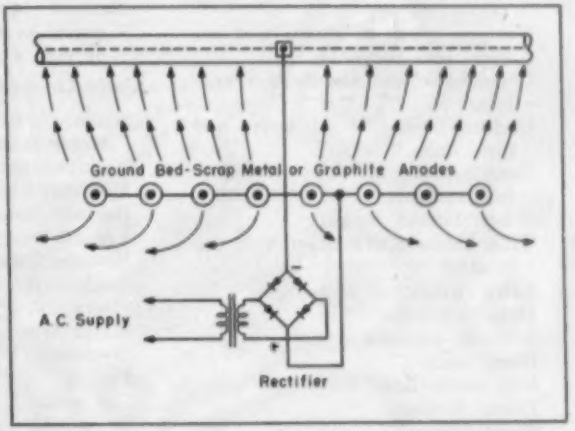



**Fig. 5 — By impressing an external current against protected installation, corrosion currents are bucked.**

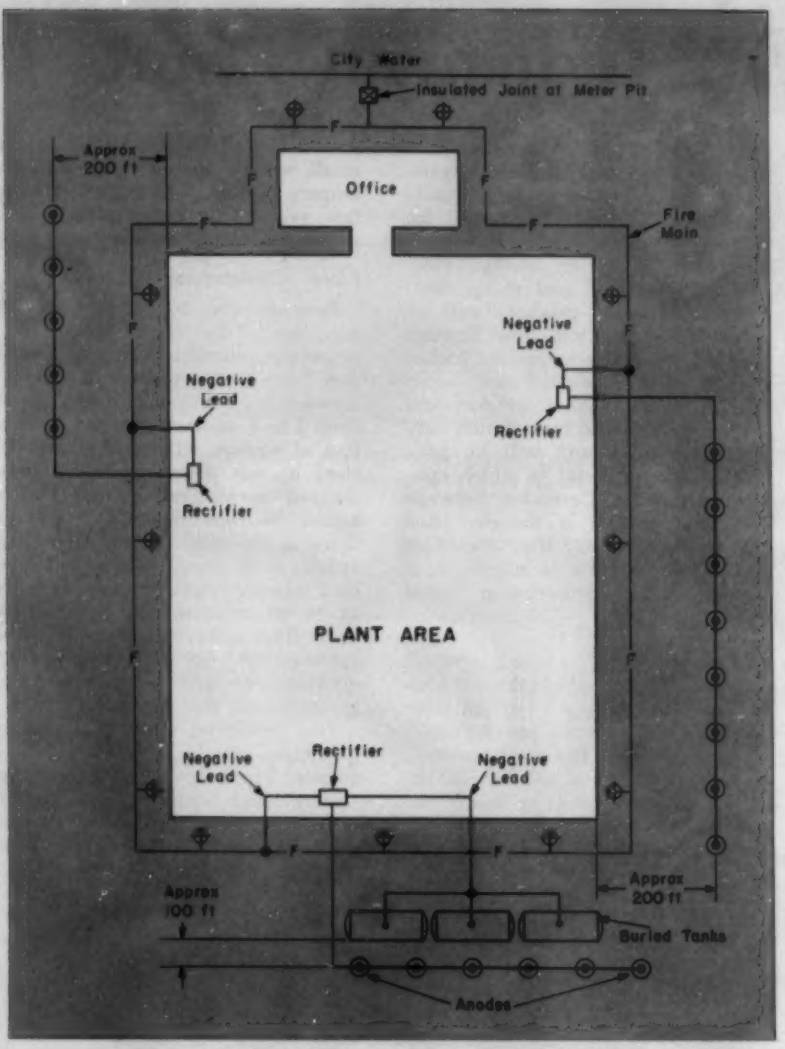



**Fig. 6 — This is the type of scheme that successfully protects buried tanks and fire mains of an industrial plant from damaging effects of corrosion.**

Buried steam and return lines (exterior)
Various types of steam and return line conduits
Compressed air distribution systems
Underground fuel oil tanks and pipe lines
Gasoline storage and distribution systems
Other buried tanks
Tank bottoms in contact with the ground
Lawn irrigation systems
Metallic sewers
Metallic culverts
Deep wells
Salt water lines
Tower footings
Sheet pilings
H-piling
Propane lines and tanks
Hydraulic lines and tanks
Radiant heating and snow removal systems (in ground, fill, or concrete)

Above-Ground Structures

Surface water tanks, elevated water storage tanks, standpipes (interiors)
Hot water storage tanks
Surface condensers
Process tanks and vessels
Sewage disposal plants
Sludge digesters, clarifiers, filters
Water treatment plants
Corrosive liquid storage tanks
Pumps
Hot wells

Most plant engineers are familiar with the use of cathodic protection in elevated water storage tanks because of the hundreds of successful installations. While this is an important use of cathodic protection which results in significant savings in many cases, it is not always of economic benefit. Weather conditions, water analysis, tank design, conditions of operation, and point of maximum corrosion are all factors which should be considered in specifying cathodic protection in elevated tanks. A thorough analysis of these problems is necessary before a truly economic balance is obtained.

## Case Histories

Case histories show the wide scope of installations which have been made. In those that follow, no attempt is made to estimate the indirect savings; as mentioned already, these are believed by competent authorities to be much greater than the direct savings.

Case 1: Isolated underground gasoline storage tanks under concrete. Protection designed for 15 years using magnesium anodes.

| Installation | Protection Cost |
|---|---|
| One 4000-gal tank | $400 |
| Group of | |
| One 4000-gal tank | |
| One 3000-gal tank | |
| One 2000-gal tank | |
| One 1000-gal tank | |
| Two 550-gal tanks | $1100 |
| Group of four 2000-gal tanks | $ 650 |
| Group of two 3000-gal tanks | $ 650 |
| One 10,000-gal tank | $ 550 |

The installed cost of a 5000-gallon tank under concrete with a moderate number of connections will be about $1600 in the Midwest. With even a fairly long life assumed for unprotected tanks, the savings from protective installations of this type are readily apparent. At the end of the 15-year period, it would be necessary to replace the protective installation to prevent corrosion from starting on the storage tanks.

## Rehabilitated Plant

Case 2: As part of the defense program, a large industrial plant in a southern city has undergone extensive rehabilitation. A corrosion survey of the plant revealed highly corrosive conditions. Cathodic protection was installed on the following facilities:

Underground fire sprinkler mains
Lead sheath cables
Underground tanks
Hot water storage tanks

Elevated water storage tanks
Cold water lines
Air lines
Butane piping
Steam and condensate return lines
Fuel oil lines
Sewage disposal lines and equipment

The coordinated cathodic protection systems for the entire installation are primarily rectifier-driven, using graphite rods for the ground beds, although some magnesium anodes are used for isolated structures. The cathodic protection installations for all of these structures, including the cost of the original corrosion survey and all subsequent engineering, cost about $80,000. The anticipated direct losses from corrosion over a 10-year period without the cathodic protection were estimated at $381,000. A saving of about $300,000 over 10 years is being realized; allowing for all power costs.

### Underground Lines

Case 3: Extensive failure on underground fire and water lines was being experienced at an industrial plant in the Midwest. The fire mains run around the perimeter of the buildings but there are branches which run under the floors of the buildings. Repairs are extremely costly. A corrosion survey showed that the corrosion was partially caused by stray currents and partially by soil conditions in the area. The survey also showed that four large underground fuel oil tanks, on which trouble had not yet been experienced, were suffering rapid and deep pitting. A cathodic protection installation, including isolation of the underground structures to eliminate stray currents, cost about $25,000 including all engineering cost. There are five rectifiers using graphite ground beds and also a few magnesium anodes in this installation. The installation protects the fire and water lines, underground fuel oil tanks, lead cables, a gas main, and the interior of a large water heating tank. The replacement and repair costs over a 10-year period without cathodic protetction were estimated at $236,000. A 10-year direct saving of about $210,000 is being realized. Fig. 6 shows the protection of underground fire mains and buried tanks at an industrial plant similar to the one described.

Case 4: At a sea coast installation, a power plant uses three surface condensers, one of 1350 square feet and two of 1000 square feet each. After 10 years of operation, the cast iron waterboxes are being protected with specially designed magnesium slabs for a cost of less than $200 per year. The slabs are shaped so that they fit into the water boxes without adversely affecting the water flow; they are mounted on the metal being protected through a calculated electrical resistance to limit the current flow and prolong anode life.

### Reservoir Tanks

Case 5: Six large pasteurizers in a beverage bottling plant were found to be suffering rapid corrosion of the water reservoir tanks; there are five in each pasteurizer. In less than two years of operation, corrosion pits had penetrated to half the thickness of the tank shells, although the tanks had originally been coated with an expensive protective coating.

Water temperatures in the tanks varied from cold city water to over 140 F. Sodium dichromate was being used as a corrosion inhibitor but, because of the necessary cyclic operation of the tanks, it was extremely difficult to maintain the proper concentration of the inhibitor. Corrosion was found to be resulting from oxygen concentration cells in the turbulent water, dissimilar metal cells between the steel tanks and the copper steam-heating coils, and from the corrosion inhibitor used. Perforation of the tanks would mean costly repairs as well as lost production from the equipment.

### Graphite Anodes

Cathodic protection systems were installed using specially impregnated graphite rods as anodes and a separate rectifier for each pasteurizer. The rectifiers supply 20 amperes at 24 volts, d-c. The systems are designed so that the current to each tank in each pasteurizer can be regulated independently because the water temperature variations require different currents for protection of the tanks. The required current densities vary as much as 15 milliamperes per square foot because of the turbulence and temperatures involved.

This cathodic protection installation, including engineering, cost less than $19,000 for the six units. The saving in inhibitive chemicals is estimated to be about $5000 per year. (In the past, the installation had to be operated so that these

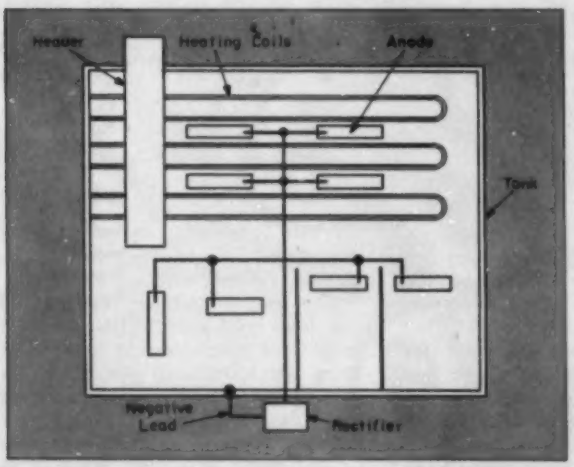



**Fig. 7 — A cleaning tank is protected by external, impressed current; rectifier current can be adjusted.**

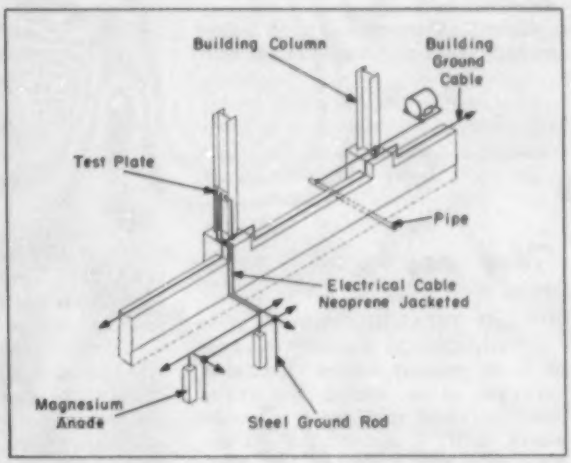



**Fig. 8 — Grounding electrical distribution systems need not be a problem if cathodic protection is used.**

inhibitors were not only ineffective but actually caused some of the corrosion.) No estimates of the direct savings were made; it was obvious enough that failure of the tanks or equipment would be extremely costly.

### Cleaning System

Case 6: Corrosion of the first three tanks of a five-tank metal cleaning and coating system was found to be so severe that leaks were occurring in the tanks after about two years of operation. The three tanks most severely affected were the cleaning, cleaning and coating, and coating tanks.

Operating temperatures ranged from 140 F to 200 F. A rectifier-driven cathodic protection system was installed using a separate circuit for each of the three tanks so that current densities could be controlled. Carbon plates were used as the anodes in this system. The rectifier capacity is 30 amperes at 7 volts, d-c. The system has been operating over two years without additional repairs being required on the tanks. Fig. 7 shows a schematic of such an installation.

Case 7: Cathodic protection was applied to the bottoms of nine 100,000- and three 80,000-barrel oil storage tanks in 1949 at an average cost of $1500 per installation. The 100,000-barrel tanks had a bottom area of 14,000 square feet each and required 1.38 milliampere per square foot for protection. The 80,000-barrel tanks had a bottom area of 11,000 square feet each and required 0.76 milliamperes per square foot for protection. Graphite anodes were placed under the tanks in long holes drilled at an angle of 30 degrees to the ground in order to secure even protection current distribution.

Case 8: Corrosion caused failure in four years of a water pump having a bronze impeller, cast iron case, stainless steel plated shaft, and bronze wear rings. A new pump having similar metal parts was given cathodic protection using magnesium anodes. No measurable corrosion was reported in three years on the protected pump. The cost of the protection was $56 for installation and $8 per year for labor and materials.

Case 9: A similar cathodic protection installation on a vertical water pump having a series of different metals in its construction cost $15 for installation and $8 per year for maintenance. Pump failures had occurred in about 18 months.

### Heated Tank

Case 10: A 1200-gallon, steam-heated water tank in a Midwest plant was found to have corrosion pits approximately half-way through the tank wall within four years of installation. Because of the tank's location and the insulation on the walls, replacement would be costly. The water temperatures were around 160 F. The complete cathodic protection installation using a small rectifier and aluminum anodes cost $550.

Case 11: Shortly after construction, a corrosion survey showed that potentially corrosive conditions existed in a commercial sidewalk snow-removal system covering approximately 2500 square feet. Cathodic protection using a rectifier and four small graphite ground anodes was installed for approximately $1100. The cost would have been substantially less had the installation been made during the original construction of the system. The protective system has been in operation over two years and no leaks have developed in the snow removal coils. Usually such systems show trouble within two years if critically corrosive conditions exist.

These cases have been chosen to illustrate some of the variety of common industrial corrosion problems that are being successfully solved by cathodic protection. It is difficult to picture an industrial plant that does not have similar or analogous problems. As cathodic protection becomes more widely understood by plant management there is no doubt but that its industrial applications will spread into many new fields.

In many plants, corrosion and electrical grounding are related problems. The modern plant has ground mats or driven grounds to provide operational safety. The copper grounds often cause galvanic corrosion of other underground structures, particularly steel pipes and lead cables. A modern solution to this problem is to provide steel grounds and to protect them against corrosion cathodically. The anodes used for the cathodic protection act functionally to reduce the resistance of the ground bed as well as to protect the other grounds from corrosion. This may be important, particularly where adequate grounds are difficult to obtain. This assures a lasting low resistance ground system which will not cause corrosion of other utilities. A schematic illustration of such a ground system is shown in Fig. 8.

### Many Variables

Installation and maintenance of most cathodic protection systems is not difficult. Like most engineering tasks, cathodic protection must be properly designed and used if satisfactory results are to be obtained. The design of a cathodic protection installation involves a great many variables and it requires experienced judgment, as well as academic knowledge to arrive at a system that is both economically and technically sound.

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## *They say . . .*

TOUGH TITANIUM attracts wide attention in industry because it is 40 percent lighter than steel and yet is as strong, but it's a 'problem child' until more is known about it, G. T. Fraser, sales manager, Rem-Cru Titanium, Inc., Midland, Pa., told a conference of executives and engineers attending the 1954 ASTE Industrial Exposition and 22nd annual meeting of the American Society of Tool Engineers in Convention Center.

"The physical properties of titanium are desirable enough for immediate use, but machining information is not available because the metal has been used very sparingly. It is known that present procedures for machining of steels does not apply, and a complete new set of procedures is being compiled for titanium", Fraser said.

The major problem, he pointed out, is of heat because titanium is a poor heat conductor, and the heat from the machining process is localized at the point of work causing tool damage. Carbon dioxide is being used for broaching titanium successfully and may lead the way to an overall solution of this important metallurgical problem.

# An Effective Salvage Program

**FRANK CHARITY**
**Consulting Engineer**

**Scrap materials, sold through company retail stores, save money for buyers and bring a better profit to the seller.**

EFFECTIVE SALVAGE operations are saving some large firms—such as E. I. du-Pont de Nemours & Co.—more than $1 million a year. Many smaller firms can probably realize proportional savings by taking a closer inventory of the contents of their trashpiles.

A closer look may reveal (among other things) that some of the items that wind up in the scrap heap aren't scrap. The salvage personnel in a large western aircraft plant recently found an electronic component worth $1500 among the discarded materials and parts they had collected. Such incidents are not unusual or infrequent.

Many of the tools, materials, and parts which are no longer needed, have little or no cash value unless they are properly sorted and marketed. Officials of a metalworking concern found that they could get $500,000 instead of $325,000 from the scrap they accumulated each year simply by hiring men to sort the materials into individual piles of aluminum, steel, and other metal groups.

Often, scrap is worth more to the firm that produces it than it is to outsiders. A number of wood product manufacturers, as an example, have realized substantial savings by using plastic adhesives to rebond sawdust particles for further use as a raw material. Many others use wood chips and sawdust as boiler fuel for heating.

An effective salvage program has secondary advantages too. If salvage personnel find large quantities of useful material coming from a given production department, management can be alerted to the existence of an unhealthy production situation sooner perhaps than could otherwise be expected.

## Salvage Collection

The initial objective of a salvage program is to arrange for the collection of scrap in a manner that is

**Salvage workers, using a pitchfork and a rake, seek items of recoverable value in a pile of scrap that could not be dumped on the regular sorting tables.**

**Using magnetic separators, ferrous and non-ferrous metal scraps can be mechanically sorted very quickly.**

**Wood and plastic scraps may be of more value to employee-hobbyists than to waste material dealers.**

least likely to interrupt routine production activities. Scrap can be collected between shifts or at times when production personnel are not working. Where the accumulation of scrap is so rapid that this procedure is inadequate, the preferred practice is to locate scrap containers in the working areas. The containers can then be periodically emptied without disrupting production work. It is also possible and sometimes profitable to install a pneumatic or mechanical conveyor system to pick up scrap at its source and deliver it to a storage area.

### Sorting Scrap

Some companies have attempted to segregate scrap at its source—that is, by providing employees with containers labeled *wood, paper, metal.* As a rule, efforts of this kind are successful only to the extent that they can be supplemented by constant supervision. Even the most reliable workers are inclined to be somewhat careless in properly disposing of scrap.

Generally, it has proven most practical to sort all the scrap in the salvage department. The common sorting procedure is to spread accumulated scrap on large tables where it can be visually inspected and manually segregated by trained salvage personnel.

Mechanical sorting has a definite place in salvage operations. Magnetic separators can be used to segregate ferrous from nonferrous materials. Vibrating screens with varied mesh dimensions can be used to separate from the dust and dirt such small parts as rivets, nuts, and bolts, commonly found in floor sweepings.

A typical batch of materials recovered in one year at Consolidated Vultee Aircraft Corp. included:

| *Type of Scrap* | *Weight, Lbs.* |
|---|---|
| Aluminum | 2,732,000 |
| Steel | 1,600,000 |
| Stainless Steel | 50,000 |
| Magnesium | 75,000 |
| Lead Dross | 72,000 |
| Kirksite Dross | 23,000 |
| Insulated Copper Wire | 50,000 |
| Brass and Copper | 12,000 |
| Wood | 1,500,000 |
| Tab Cards | 350,000 |
| Waste Oil, Solvents | 307,000 |
| Total | 6,771,000 |

At first glance, it may seem that a salvage procedure suitable for a large aircraft plant would not be suitable for most concerns. But airplane production, even in times of national emergency, is an operation that involves the fabrication and assembly of relatively limited quantities of identical parts. Therefore, the cost of efficient salvage work in an aircraft plant is proportionally the same as it would be in a relatively small factory doing custom work.

### Packaging and Disposal

Once sorted, salvaged materials must be packaged and disposed of in the best interests of the company. Whenever there is any possibility that the scrap can be re-used in a production operation, the first choice should be given to the production department concerned—since it can be safely assumed that no usable merchandise could be purchased by the company for anything approaching the prices paid for scrap and waste materials.

### Competitive Bids

Where large quantities of certain types of scrap are accumulated that are of no further value to the company, it is a good idea to obtain competitive bids from three or more scrap dealers. Small quantities of scrap can frequently be disposed of most profitably on a contract basis—that is, by selling to the dealer who offers to pay the most on a weekly or monthly basis over an extended period of time—since few prospective buyers are willing to bid competitively and repeatedly where the prospects of profits are slight.

### Company Retail Stores

A number of companies now dispose of certain types of scrap—for example, wood and plastic materials—through their own retail stores to employees and other individuals who can use the materials at home. Besides saving time and money for the buyers and creating employee goodwill, such sales usually bring the company a higher return than

**Sorted scrap materials should be placed in labeled containers pending the time they can be disposed of profitably.**

could be expected from scrap dealers sales outside the company.

The feasibility of reprocessing scrap for further use depends on the amount and cost of reprocessing required, and the quantity and potential value of the materials to be reclaimed. A small woodworking concern might find it less expensive to burn a hundred pounds of sawdust each week than to buy the presses, molds, and other special facilities that might be required to rebond the sawdust particles with plastic resins for further use.

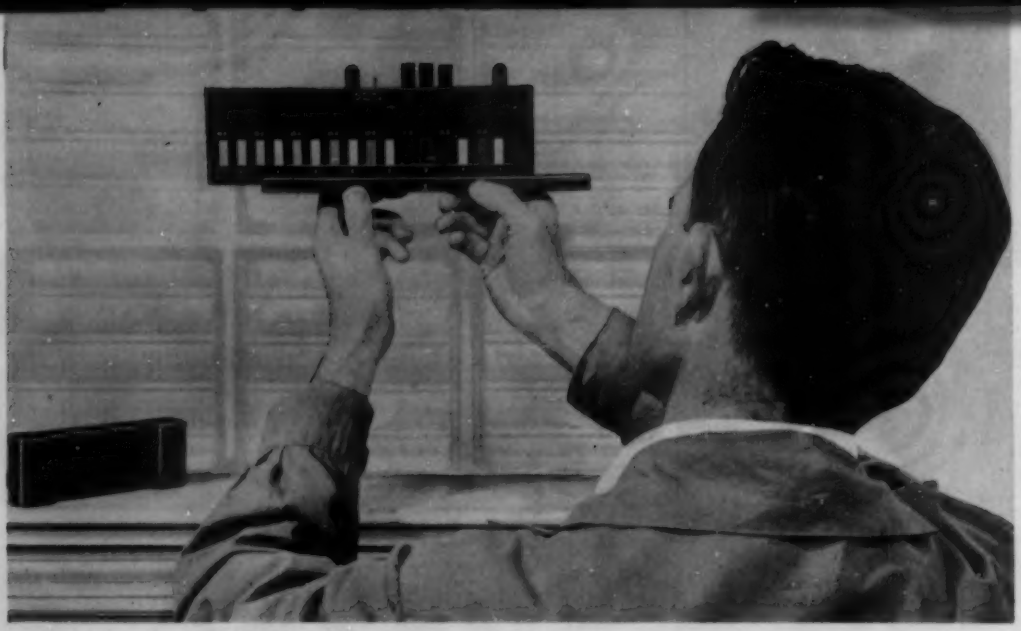
On the other hand, it is well to remember that a reclamation process may have a value that cannot be computed in terms of the scrap produced by any one company. A Massachusetts leather manufacturer installed some elaborate facilities for the rebonding of "leather dust"—a powdery material produced in buffing leather products—with elastomeric resins. He realized from the start that his company did not produce enough leather dust to merit an investment in the reclamation equipment; but, at the same time, he knew that a large number of competitors faced a similar problem.

As a result, he is now buying his competitors' leather dust, reclaiming the dust for his own use at about half the price he once paid for hides, and manufacturing finished products which—without a sacrifice of quality—bring a better margin of profit, despite a lower cost to the consumer.

The subject of salvage as seen by one Midwestern factory owner is interesting. He said, "Scrap is fundamentally worthless. If we can sell it, fine. Otherwise, we're lucky if we don't have to have somebody to haul it away. So why should we waste a lot of time and money establishing a salvage program!"

A few days later, following a survey by an independent engineering consultant, this manufacturer learned that the scrap which was being hauled away from his plant free of charge had a cash value of about $20,000 a month.

**A load of scrap is dumped onto a sorting table where it is first visually inspected and then manually separated and classified.**



Comparators greatly facilitate test procedures that are required for proper water treatment control.

# Water Treatment Adjustments

L. W. FITZPATRICK, Chief Engineer
Department of Corrections, Jefferson City, Missouri

IN A BROAD SENSE, water treatment is essentially the application of a combination of chemical ingredients designed to stabilize a water so that it remains noncorrosive, does not form scale, and is suitable for use in a particular thermal process or operation. However, no basic chemical principle can be used to determine whether or not scale will form. Physical characteristics of the precipitated sludge determine whether it will adhere to boiler surfaces.

Minimum calcium and magnesium scale formation requires internal treatment formulation and adjustment that not only precipitates these salts as a suitable sludge, but maintains the sludge in a nonadherent state for removal by manual and continuous blowdown. Calcium salts are more difficult to control than those of magnesium since the latter readily precipitate with boiler water alkalinity as a magnesium hydroxide floc. Calcium precipitates, which are more dense, do not readily floc.

Once calcium and magnesium salts have been precipitated, organic compounds enter the reaction to maintain this sludge in colloidal suspension. These specific materials have an all-encompassing action, engulfing the precipitate and keeping the entire mass fluid for blowdown.

Blowdown depends entirely on the quantity of sludge formed, and the concentration of dissolved solids coupled with boiler water alkalinity. Generally, fluid sludges require less blowdown than dense sludges, and this accounts for the almost universal use of organic compounds in preparations for water treatment.

## Control

Both internal and external treatments, regardless of manufacturer, require close control. Frequent tests must be performed (on-the-hour in many plants) to assure optimum results. With internal treatments, hardness is the regulating factor for the phosphate whether an organic phosphate or organic carbonate is used, because the carbonates almost invariably contain a percentage of phosphate. Control is simply the maintenance of a predetermined quantity of residual phosphate in the boiler drum at all times sufficient to react with the hardness entering in the makeup water.

With the basic hardness and phosphate control to eliminate scale formation, other tests, such as chloride determinations and alkalinity to phenolphthalein or methyl orange, normally are employed to complete the general plant procedure. Sufficient alkalinity is needed to properly precipitate scale forming salts, while chloride content is used to determine over-all control of manual and continuous blowdown. Sulfate, sulfite, silica, nitrate, specific conductance, total solids, and dissolved solids tests have value for some conditions, but all of these procedures rarely are required in any one plant for satisfactory treatment control.

## Dissolved Solids

For greatest economy, the rate of boiler blowdown should be controlled to carry dissolved solids as high as practical without causing difficulties from excessive concentrations. Naturally, the upper limit of concentration depends on the particular installation and can be determined only after suitable tests. One method is to purposely build up the concentration with the boiler loaded, take samples of condensed steam and boiler water, and tabulate the results. Then the dissolved solids content when appreciable carryover first occurs is the upper limit for future water concentration.

In many instances, the established American Boiler Manufacturers Association limits for total solids can

be safely exceeded by about 10 percent when suitable antifoam additions are utilized. This is, of course, based on adequate sludge removal in properly proportioned boilers and satisfactory alkalinity balances. Any rate of blowdown much over 5 percent generally is considered excessive by many plant engineers, as it indicates waste because of a deficiency in softening equipment.

### Concentration Indicators

Several factors can be used as individual indicators of the allowable boiler water concentration in any particular plant. Suspended solids are often the main factor in determining concentration limits because these solids frequently promote carryover and develop boiler scale.

Alkalinity when in the upper limits promotes foaming. Control tests by this method always should be used in conjunction with other blowdown factors since alkalinity varies with internal treatment compounds. It is necessary to have a definite upper alkalinity limit beyond which blowdown should commence regardless of any other factor.

The general formula: 2 x (P x alkalinity) - (M x alkalinity) should always equal a figure over 170 but under 425 ppm. For the phosphate reaction, P alkalinity must be greater than ½ M alkalinity, and M alkalinity must be at least 200 ppm. This assures a minimum pH of 9.6 in a steaming boiler, equal to 10.5 pH at room temperature. Total alkalinity often must be controlled so as not to exceed 20 percent of total boiler water concentration when solids approach the upper limits.

With high pressure operation, silica is the sole determining factor and blowdown rate must be based on the maximum allowable silica content of the water. On the basis of silica content it is possible to calculate concentrations of the other substances in the water when silica is at maximum range. Experimentation will show a definite relationship of all substances for any selected silica value. However, using alkalinity for the control of silica is not practical since alkalinity will not necessarily vary with water concentrations because of the addition of chemicals.

Satisfactory chemical treatment feeding is equally as important as control of chemical balance. In any installation, constant controlled application of treatment is preferable to shot feeding methods, which induce undue concentrations of materials in boilers at one time and often tend to promote scale formation near the inlet in the drums.

Proper use and interpretation of boiler blowdown aids maintenance of good water conditioning. Most authorities agree that a surface blow is more effective than a bottom blow in removing dissolved and suspended solids from steaming boilers. This is especially important when foaming, priming, and carryover occur, in which case a surface blow always should be used.

In modern boilers most solids are in solution and suspension and are readily removed from steaming drums at a low point below normal water level. With this system of operation, lower blowoff valves still are opened occasionally to discharge sludge and settled-out materials from lower headers and mud drums.

Continuous blowdown connections should always be made at the end of steam drums where the highest water concentration exists. However, care should be exercised to assure that the blowdown connections are not made adjacent to the feedwater inlet to avoid short-circuiting between these services. If treatment is introduced separately, the location of the chemical feed line also must be considered.

### Effect of Load

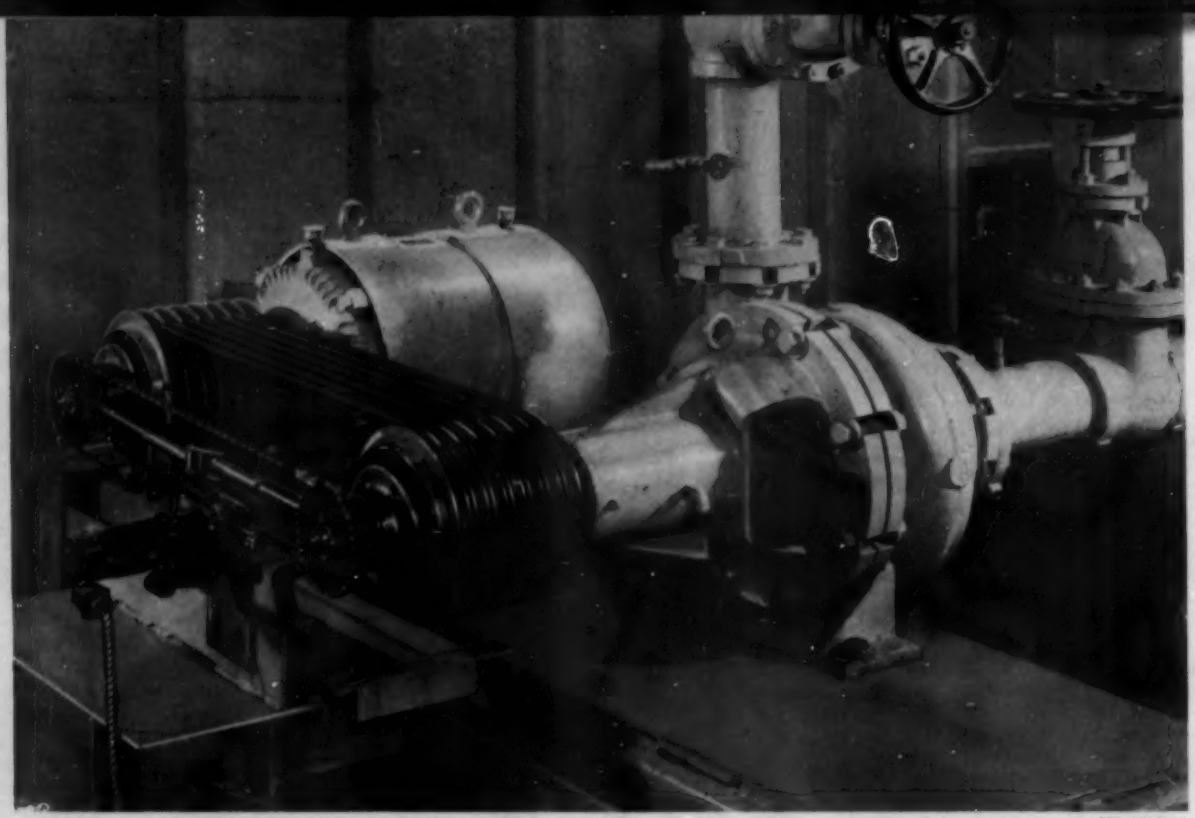
Since water carryover in steam is affected by general boiler design and steam space available, the water level in the drum and the load characteristics are important. Constant ratings will give less trouble than variable ratings because the possibility of carryover increases where rapidly rising load causes high water levels. Where steam is carrying away some water due to high moisture content, often the peak concentration will be slightly lower and the average concentration will be somewhat higher if the continuous blowdown rate remains constant.

Continuous blowdown is especially economical since less equipment is required to recover flash steam and heat because the small quantity of water being removed is easily controlled. It is a must in larger plants where modern boiler units require the maintenance of low concentrations with consequent increase in the rate of blowdown.

**RECOMMENDED AVERAGE CONTROLS FOR INTERNAL TREATMENT AT VARIOUS OPERATING PRESSURES**

| Operating pressure, psig | To 200 | To 450 | To 900 | Over-1500 |
|---|---|---|---|---|
| Hardness | 0 | 0 | 0 | 0 |
| Phosphate, ppm | 30-50 | 30-50 | 30-50 | 30-50 |
| Hydroxides, ppm as $CaCO_3$ | 150 | 130 | 100 | 50-75 |
| Total alkalinity, ppm | 200 | 160 | 120 | 60-100 |
| Silica, $SiO_2$, ppm | 150 | 50 | 30 | 10 |
| Total solids, ppm | 3500 | 3000 | 2000 | 1300 |
| Suspended solids, ppm | 600 | 500 | 300 | 150 |
| Total solids, ASBMA | 3500 | 3000 | 1500 | 1000 |

**Very complete chemical laboratories are a prime requisite in utility plants.**



Allis-Chalmers

**Dual manually adjustable multi-groove sheaves connecting a 40 HP motor and pump for variable volume pumping service.**

# Dual Variable Pitch Pulleys

## Widen the Range of Speeds

**RICHARD LeBARON BOWEN, JR.**
**President and Treasurer**
**Coated Textile Mills, Pawtucket, R. I.**

ONE OF THE major advances in the field of power transmission has been the development of a variable pitch motor pulley which can be mounted directly on the motor shaft. Utilizing the full speed of the motor, it requires smaller belts than ordinarily used on other variable transmissions.

Recently, variable pitch companion sheaves have been introduced that supplement the adjustable motor pulleys and that generally double the range through which speed can be varied.

Single variable pitch motor pulleys were described in an INDUSTRY AND POWER article (August 1953) where it was shown that the main limitation to their use with fixed diameter companion sheaves was the relatively low ratio of speed variations—3:1 in most cases. By using two adjustable sheaves, the range for pulleys with a 3:1 ratio becomes 9:1 since the total speed variation is the product of the ratios of each pulley.

In operation, one of the sheaves is usually spring-loaded. The other sheave is manually adjustable. Speed change is made by adjusting the manually operated pulley. In one arrangement, a threaded stud applies thrust to one side of the adjustable sheave. When this stud is tightened, the two faces of the manually controllable sheaves are forced together, increasing the pitch diameter, and forcing the belt to ride at a larger radius. Movement of the adjustable pulley simultaneously produces an opposite movement of the spring-loaded pulley, forcing the two disks apart and causing the belt to ride at a smaller pitch diameter. This changes the speed of the manually adjusted pulley with respect to the spring-loaded pulley.

There are a number of types of this variable speed equipment available from the manufacturers. In the Speed Selector design, one face of each pulley is fixed to its respective shaft. The other face is suitably splined and mounted so that it will slide on a hub also fixed to the shaft. The manually adjustable pulley is controlled by a threaded stud mounted in a fixed bracket and resting against a sealed ball thrust bearing. A restraining arm keeps the

control stud from turning with the pulley when in operation.

The two pulleys have only three moving parts, including the thrust bearing, but not counting the spring. The centerline of the belt is not fixed and moves from side to side. However, correct belt alignment is maintained at all times since the movement of the inner face of the spring-loaded sheave corresponds with the movement of the manually adjustable sheave. (The manually adjustable sheave should be mounted on the driven shaft.) In the wide range of speed changes (6:1 to 8:1), these units have ratings of from ¾ to 5 hp.

### Roto-Cone Design

The Gerbing Mfg. Corp. has a unit designed around two of its Roto-Cones. The two faces of each sheave are kept equi-distant from a fixed centerline by a pinion common to racks (which serve also as keys) fastened to each disk. A single spring in each sheave tends to close the cones. However, the spring in the manually operated pulley is weaker. This allows the sheave to be opened by the other sheave whenever its faces are not forced together. The manually adjusted pulley is operated by a thrust yoke which holds two torque arms connected to a thrust bearing on the outer disk.

The unit uses wide V-belts. There are a total of seven moving parts on the two sheaves, not counting the two springs. In the high range of speed variations (6:1 to 9:1), the ratings of these units lie between 1/4 to 10 hp. These pulleys must be used with a motor rpm not greater than 1160 rpm for high speed ratios.

The Lewellen units are similarly designed so that the two faces of each pulley are kept equi-distant from a fixed centerline. This is done by a pivoted link which contacts both disks through slots in each hub. The link not only moves the disks equally and in opposite directions, but drives both disks; the keys used in other designs are eliminated and the possibility of wobbly disks is minimized.

The Lewellen manually adjustable sheave has a pair of screwed sleeves (rather than an external stud and thrust bearing) for forcing the faces of the pulley together. The pair of sleeves is held stationary by a torque arm so that the pulleys can be adjusted while in motion.

There is a total of eleven moving parts in the two pulleys (considering the shifting sleeve and bearings as one). The link and pins are hardened steel members with ample bearing areas designed for low bearing pressures. Either pulley can be mounted on the motor. Wide V-belts are suitable. The units are rated from 1/6 to 5 hp at speed variations from 4:1 to 9:1. Either an 1160 or an 860 rpm motor can be used for these high ratios.

### Swiss Version

A Swiss version of these dual pulleys has recently been entered in the American market by the Gubelin International Corp. The faces of each disk are kept equi-distant from a fixed centerline by a pivoted link which has a certain similarity with that used in the Lewellen units. In this model, the link has no pins but rests instead in slots in each disk. The two disks are keyed together with a single key. The pulleys can be regulated while in motion by adjusting a pair of screwed sleeves held stationary by a torque arm. The unit differs basically from the Lewellen since it has a spring in the manually adjustable pulley as well as in the automatically adjustable pulley. It is similar to the Gerbing pulleys in this respect.

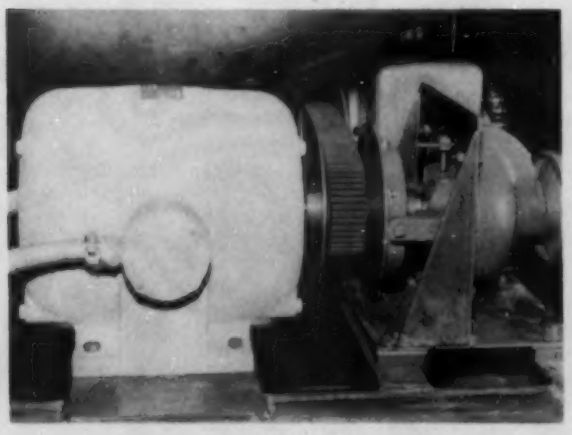
These Swiss models can use standard American wide V-belts. Some of the pulley combinations have a speed variation as high as 16:1 with ratings from ½ to about 15 hp in size.

The Reeves Pulley Co. manufactures a totally enclosed motorized variable speed transmission which utilizes a pair of variable pitch pulleys. A manually adjustable pulley is mounted on the motor shaft and the shaft then projects into the housing of the drive. A spring-loaded pulley is mounted on the driven shafts. The manually adjustable pulley is regulated by a threaded stud which presses a yoke against a thrust bearing retained by the hub of the sliding disk—similar to that of the Gerbing manually adjustable pulley discussed.

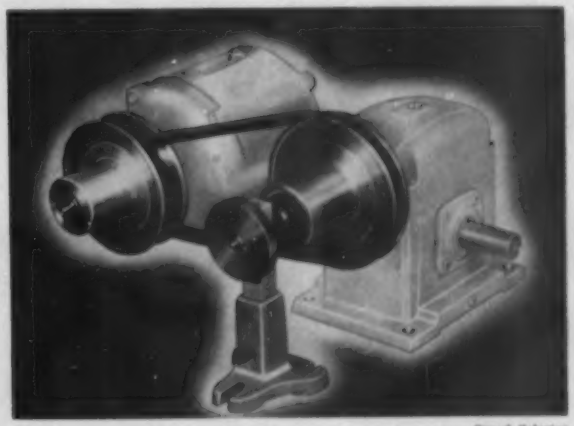
### Moving Parts

Not counting the spring, there is a total of only three moving parts in the two pulleys. These units use wide V-belts. The manually adjustable pulley must be mounted on the motor shaft. The smallest size is rated at ¾ hp with an 1800 rpm motor and has a speed variation of 10:1. The maximum speed variation of the other units is 6:1 with a maximum rating of 25 hp. From 5 to 25 hp, the pulleys must be used with 1160 rpm or smaller motors.

U. S. Electric Motors also manufacture totally enclosed motorized variable speed transmissions of this general type using a manually operated and spring-loaded variable



**Reeves pulley showing the manually adjustable pulley on the motor with the adjusting handwheel at right.**



Speed Selector

**Increasing pitch diameter of manually adjustable pulley (right), automatically decreases other diameter.**

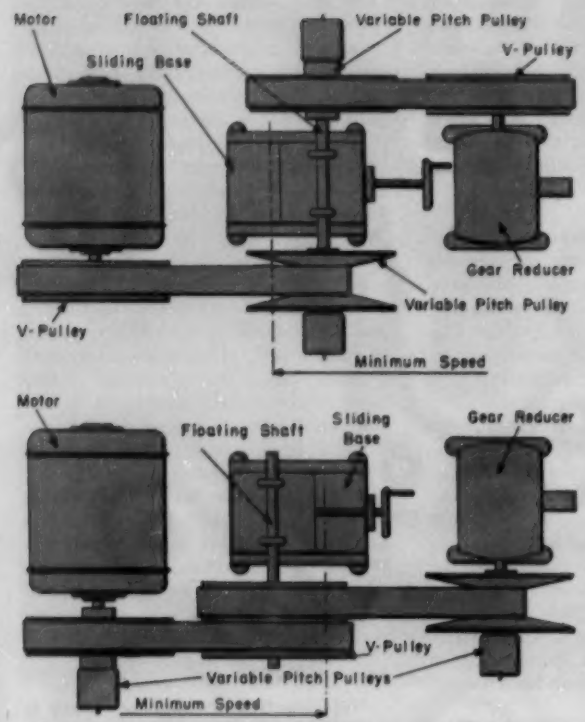



**Fig. 1 — Two ways to get a wide ratio of speed variation using variable pitch pulleys and a floating shaft.**

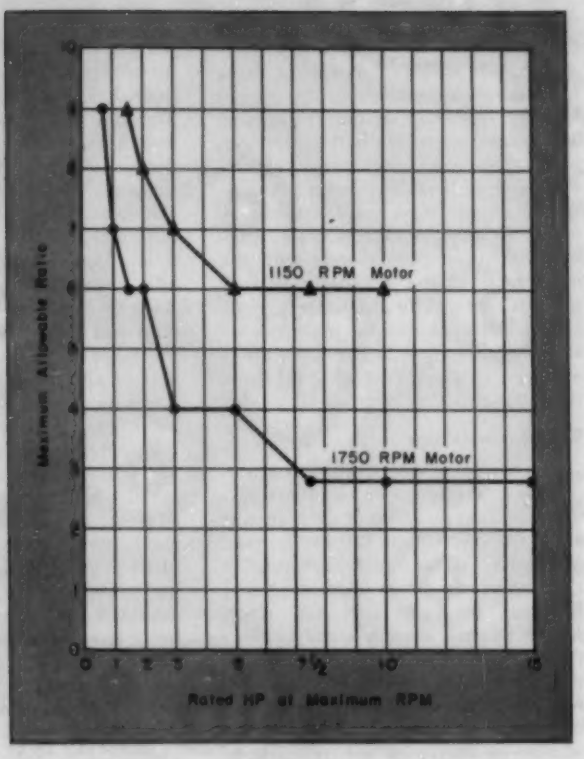



**Fig. 2 — Effect of motor rpm on maximum allowable speed variation of variable pitch pulleys used in pairs.**

pitch pulley form of arrangement.

It is possible to get a wide range of speed variation using two standard spring-loaded variable pitch motor pulleys and a floating shaft. Two arrangements of these components are shown in Fig. 1. In the lower illustration, a variable pitch pulley mounted on the motor shaft drives a pulley which is mounted on a floating shaft. This pulley (or another pulley on the same floating shaft) drives a second spring-loaded variable pitch pulley mounted on the driven shaft. As shown, it acts as the input to a gear reducer.

In the upper illustration, the two variable pitch pulleys are mounted on the floating shaft and regular pulleys are mounted on both the motor and the driven shaft. Variation in speed is produced by moving the floating shaft either toward or away from the motor. Both arrangements are shown in the maximum speed position. For minimum speeds, the floating shaft is moved so that the pitch diameters of the adjustable pulleys are reversed. The sliding base on which the floating shaft is shown mounted is similar to those on which the motor is mounted when a single variable pitch motor pulley is used with a fixed diameter sheave in a power transmission.

These applications are more complicated than those where a spring-loaded pulley is used with a manually adjustable sheave. With this floating shaft arrangement, an additional belt is required, several extra pulleys, floating shaft, bearings, and a special sliding base to move the floating shaft between the motor and driven shaft—all of which might double the cost of two adjustable sheaves and a single belt. One advantage in using two simple spring-loaded pulleys is that the lateral thrust present with some manually adjustable sheaves is eliminated.

## Advantages

In a variable speed device, using one variable pitch motor pulley and one manually adjustable pulley, the speed must be changed when the device is in motion. If the manually adjustable pulley is tightened when the pulley is stopped, lateral pressure is put on the belt and it is gripped extremely hard. It is not unusual for the belt to snap when the motor is started. In the arrangement using a floating shaft, such damage is impossible. When the pulleys are stopped, the belt simply forces one pair of disks apart and allows slack on the other belt.

Most of the variable pitch pulleys discussed have a nominal ratio of 3:1. When two are used together, the total possible ratio is 9:1. In a simple arrangement, the driven shaft would rotate at one third the motor speed when the motor sheave is at its minimum pitch diameter. However, when the motor sheave is at its maximum, the driven shaft will travel at three times the motor speed. With a 1750 rpm motor, this would be 5250 rpm—a rather formidable figure considering that the rim speed of a 13 in. diameter companion sheave rotating at this rate would be about 18,000 ft per minute.

Since centrifugal force can cause cast iron pulleys to disintegrate, it is common practice to limit the rim velocity of ordinary V-belt sheaves to 5000 ft per minute. With specially designed and balanced pulleys, rim speeds of 7000 ft per minute can be safely used. A 15 in. diameter variable pitch pulley mounted on a 1750 rpm motor has a rim speed of about 7,000 ft per minute, and the belt speed at the maximum pitch diameter would be about 6500 ft per minute in this case.

It should be realized, however, that the type of variable pitch pulleys discussed do not have rims in the sense of a multi-groove or a flat-faced pulley. The rim on each disk

feathers away. Thus, much higher rim speeds may be used with safety.

Speed Selector recommends that all their pulleys be installed on 1750 rpm motors. Therefore, rim speeds of the driven pulleys at maximum speeds run from about 6000 to over 11,000 ft per minute (largest pulleys 8½ in. diameter). While Speed Selector uses standard A and B belts, Gerbing, Lewellen, and Reeves use wide V-belts. These necessitate larger diameter pulleys (a maximum of 13 in. for Gerbing and Lewellen and 15 in. for Reeves).

Since a 13 in. companion sheave traveling at 5250 rpm would have a rim velocity of about 18,000 ft per minute—obviously excessive—Gerbing has selected 10,000 ft per minute as a safe operating rim speed for their companion sheaves; Lewellen limits their large sheaves to about 8500 ft per minute; and Reeves has limited their large pulleys to about 9000 ft per minute.

### Limitations

When using a 1750 rpm motor, the maximum speed of the Gerbing, Lewellen, and Reeves companion sheaves must be mechanically limited. This is done by making the center distance between the two pulleys greater than the minimum possible distance for any particular belt—thereby limiting the ratio of both pulleys equally. With the larger units, the speed ratio is thus limited to from 2:1 to 3:1 when using a 1750 rpm motor.

In certain instances, there are also limits on the belt imposed by a combination of the belt speed and the minimum pitch diameter of the driven sheave. To get a large speed ratio with either Lewellen, Reeves, or Gerbing units, an 1160 rpm motor must be used. Then, ratios of from 5:1 to 6:1 are possible for the higher horsepower units. With a 1750 rpm motor, the full 9:1 ratio can be obtained with the smallest Gerbing and Reeves units but is not possible with any of the Lewellen pulleys.

The arrangement of pulleys shown in Fig. 1 is also subject to limitations of speed and ratio. Again, this is due to the maximum permissible speed of the pulleys and to limitations imposed by belt speed and minimum belt pitch diameter. The lower illustration of Fig. 1 is more practical for large horsepower units because at maximum speed only the driven shaft travels faster than the motor. A variable pitch pulley, with its weight concentrated close to the shaft, is mounted on the driven shaft thereby avoiding the use of a V-pulley with a bulky rim.

With the type shown in the upper illustration of Fig. 1, both the driven shaft and the floating shaft travel faster than the motor. While a floating shaft traveling at several times the motor speed is no problem in itself, there is the fact that the speed of the belt connecting the floating shaft and the driven shaft is several times that of the driving belt. Besides this, a V or flat-faced pulley is mounted on the driven shaft. On the larger horsepower units, the maximum allowable rim velocity of this pulley would limit both the maximum ratios and the maximum rating. For example, if a 13 in. flat-faced pulley were used, and if the maximum allowable rim speed were 5000 ft per minute, then a ratio only a little more than 2:1 would be possible, disregarding any limitations imposed by the belt.

### Multi-Grooved Pulleys

Allis-Chalmers manufactures a multi-grooved spring-loaded pulley which can be used with manually adjustable sheaves. The pulleys use wide V-belts and have up to three grooves; but together they only have a speed variation of about 3:1. The drive must be stopped to change the pitch diameter of the manually adjustable sheave. The combination is available in ratings up to 30 hp, and on special order up to 40 hp.

Allis-Chalmers also manufactures a pair of adjustable sheaves (double motion control vari-pitch drives) which operate on fixed centers but only give a speed variation of 1½:1. Instead of one spring-loaded pulley and one manually adjustable pulley, both these pulleys are manually adjustable multi-grooved sheaves with threaded sleeves on which all the right-hand or all the left-hand faces are mounted. The pulleys use standard V-belts and have up to 10 grooves.The two pulley controls are connected with chains and sprockets so that by turning a handwheel, one sheave automatically increases its

**Fig. 4 — (Right) A pulley adaptation where sliding disks are kept equi-distant by means of a pivoted link.**

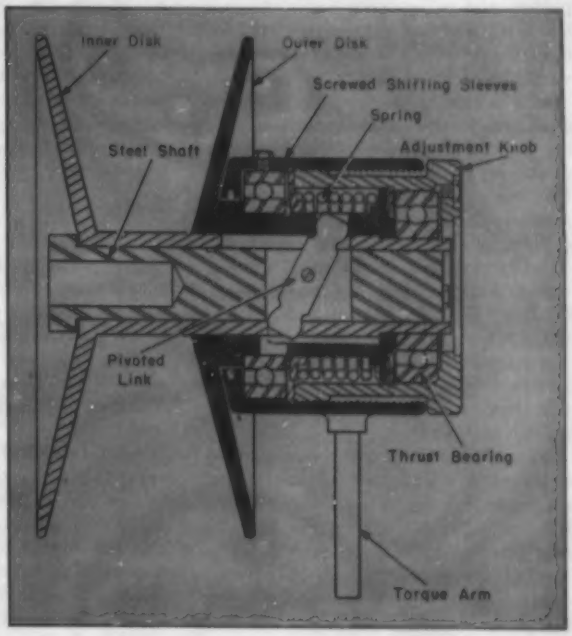
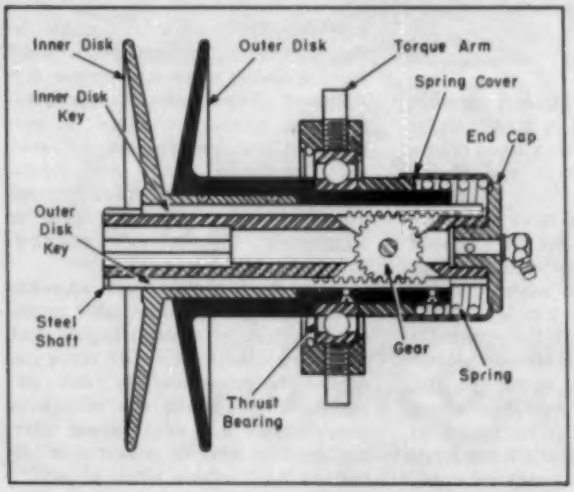



**Fig. 3 — Cross-section of manually adjustable pulley with sliding disks and a pinion and rack arrangement.**



pitch diameter while the other decreases. A valuable application for these multi-grooved adjustable sheaves is in the range from 25 to 150 hp installations.

### Drive Characteristics

The characteristic of the variable pitch motor pulley when used with a simple fixed diameter sheave are: a speed ratio of 3:1 (occasionally 2:1 or 4:1); a variable center distance between the motor and the driven shaft requiring a special sliding motor base; maximum output speeds ranging from the motor speed to about one-half the motor speed; and a maximum rating of about 15 hp.

The characteristics of the variable pitch pulley when used with a manually adjustable companion sheave are: a speed ratio of from 6:1 to 16:1; a fixed distance between motor shaft and driven shaft centers; a maximum output speed several times greater than the motor speed; and a maximum rating of about 25 hp. With two variable pitch pulleys, no sliding motor base is required since the center distance is fixed and belt tension is automatically maintained by the pulley spring. Two spring-loaded variable pitch pulleys used with a floating shaft between the motor and the load have these same characteristics.

The characteristics of the dual manually adjustable pulleys are: a speed ratio of 1½:1; a fixed center distance; a maximum output speed about 25 percent greater than the motor speed (for the same size pulleys); and a rating of 150 hp.

When using a variable pitch motor pulley and a fixed diameter sheave, the maximum output speed at the maximum pitch diameter of the variable pitch pulley can be originally designed in the range from about motor speed down to half motor speed by properly selecting the diameter of the companion sheave. However, with variable pitch companion sheaves, the speed of the driven sheave is quite definitely fixed by the speed of the motor and the maximum ratio of the pulleys. With a 1750 rpm motor and pulleys with 3:1 ratios, the maximum output speed is 5250 rpm. With an 1160 rpm motor and the same pulleys, the maximum speed of the driven pulley is 3450 rpm.

It is evident that when using these drives the maximum output speed may possibly be two or three times the motor speed. Since the desired machine speed is often only a fraction of the motor speed, speed reduction is usually required between the drive variable pitch sheave and the machine that is being driven.

When variable pitch motor pulleys are compared with variable speed mechanical power transmissions having two pairs of adjustable conical disks mounted on two shafts, many inherent advantages of the variable pitch motor pulleys become evident.

In the first place, since the variable pitch motor pulley is mounted on the motor shaft, the power consumed in turning the transmissions is eliminated. These transmissions require eight bearings: four on the frame to hold the shafts and four thrust bearings for forcing the disks together. Since the input speed of these transmissions is often relatively slow (from 300 to 700 rpm for one common type), the shafts, and thus the bearings, are many times larger than those that would be required at higher speeds. When a variable pitch motor pulley is mounted on the motor shaft, all eight bearings and their resultant maintenance are eliminated. The speed reducer required between the motor and the transmission is also eliminated.

The belts used with variable pitch motor pulleys are only a fraction of the size required with the double adjustable sheave transmissions. Since belt speeds up to 6500 ft per minute are used, maximum horsepower can be developed from the belts. Changing belts is simple in comparison with the maintenance work required to change belts on double sheave transmissions. Because the variable pitch motor pulleys are spring-loaded, belt tension is automatically taken care of. This is a very important point of comparison with the double sheave transmission. The only time belt tension on the latter can be adjusted is after the belt is already slipping, causing erratic speeds and a jerky transmission of power with the corresponding lack of uniformity of operation and product.

### Adaptations

The size limit of these variable pitch motor pulleys is about 15 hp when used singly with a fixed diameter companion sheave and 25 hp when used in pairs. There are many plants which do not have any motors larger than 25 hp. At Coated Textile Mills, a single variable pitch motor pulley is used when the desired speed ratio is 3:1 or less; if the ratio is greater than 3:1, a manually adjustable companion sheave is used with the adjustable motor pulley. Of the dozens of variable speed power applications to be found at Coated Textile Mills, all have been solved by one of these two arrangements of variable pitch pulleys.

Both types of pulleys can be easily adapted to automatic control. Generally, this control consists of electric pilot motors for moving the shifting mechanism. Another method uses a small electric motor to simultaneously and oppositely change the pitch diameters of both pulleys.

Variable pitch pulleys are probably the best solution for a power transmission problem if the speed ratio is less than 6:1; if the horsepower is less than 25; and if the operating conditions do not demand a totally enclosed variable speed transmission. These conclusions are based on the fact that: the variable pitch pulleys constitute the cheapest known form of variable speed power transmission; they are one of the most compact forms; and they are the easiest to maintain.

### Lack of Acceptance

The seeming lack of acceptance of variable pitch pulleys for power transmission is probably due to several factors. First, the designs are relatively new. Although several of the larger manufacturers of variable speed equipment did manufacture these pulleys over ten years ago, they did not appear anxious to push them. Only in the last five years has competition noticeably increased the sales effort.

A more important reason may be that the power transmission industry tends to be moving towards "packaged units" and "pre-engineered products." The variable pitch pulleys are a move away from a packaged unit since a complete transmission must be purchased in "pieces." The motor is purchased from one source, the variable pitch pulleys and belt from another source, and a gear reducer—if needed—from a third.

There is a slight amount of engineering necessary: the belt length must be calculated, a bracket for the threaded stud provided, and in some cases a thrust yoke and torque arm designed. Admittedly, some manufacturers appear reluctant to recommend possible designs for such parts as thrust yokes and torque arms although most application engineers are extremely helpful in suggesting installation arrangements.

Many plant people seem too ready to accept a packaged variable transmission unit, at a much higher cost, with larger bulk, and with more potential maintenance. In our experience, it is worth the additional investigation and engineering effort required to analyze potential applications for variable pitch pulleys.

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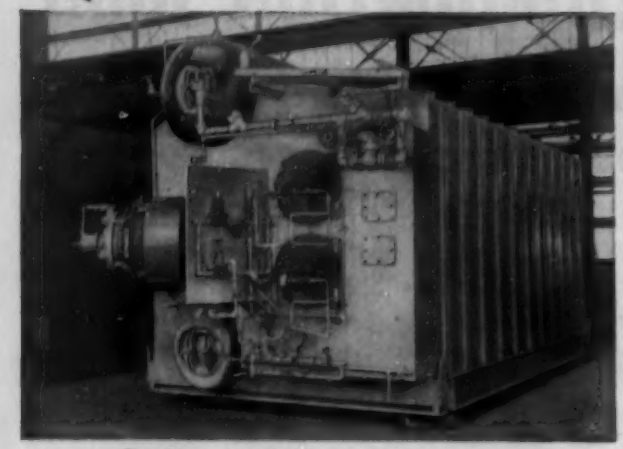

*Two-burner installation, typical of larger sizes.*

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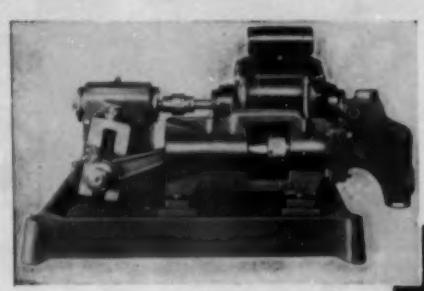

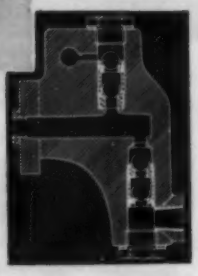

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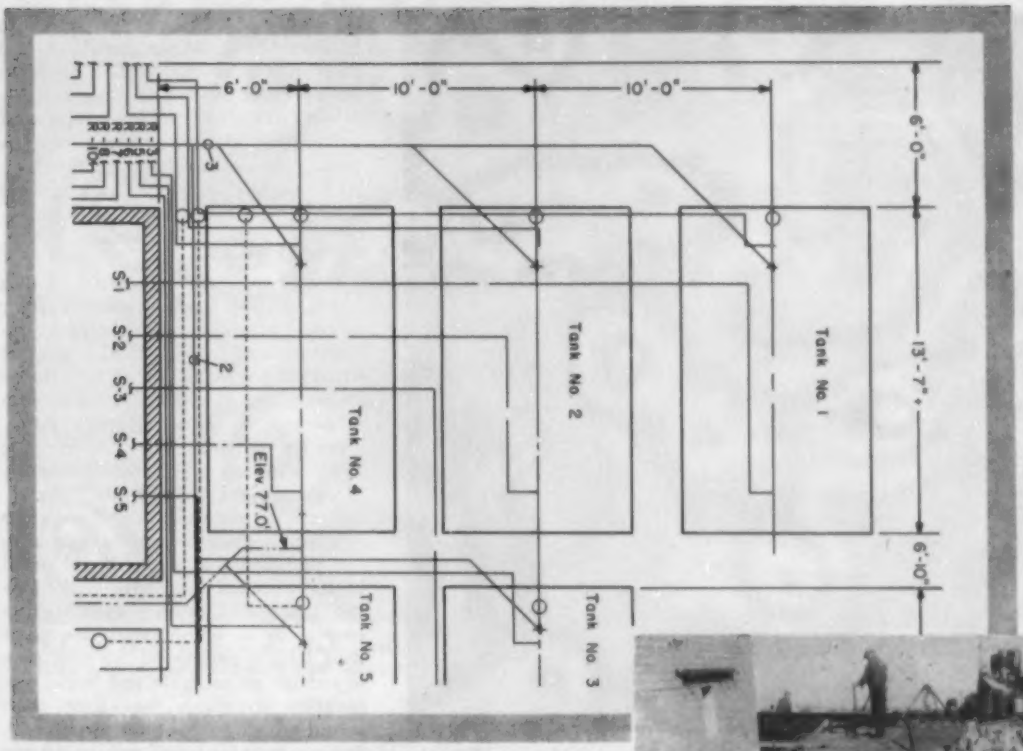


**Layout drawings of piping are difficult to follow and seldom show exact locations of the pipes. In direct contrast, photographs show how each line was installed — enable maintenance engineers to see what is below ground.**

# Construction Photos Pay Dividends ...Year after Year

**WILLIAM J. COLLIER, Plant Engineer**
**Tapco Division, Thompson Products, Inc.**

FOUR YEARS ago Thompson Products, Inc. instigated the practice of taking progress photographs of all construction work at its Tapco Division plants. These photos, used to supplement written construction reports, were found to be of considerable help to the plant engineering department since they enable the engineers in the office to keep in constant touch with progress in the field without needing to make frequent visits to the site.

In addition, when the location of a pipe is changed in the field, or an extra trap is decided upon at the last moment, the photos taken during construction are a valuable aid to the draftsmen when the drawings are being revised to show field changes. Since the changes are accurately pictured in the photographs, it also lessens the amount of paper work required of the engineers in the field, thereby allowing them to devote a greater portion of their time to the more important function of supervising the construction work.

Much of the work at the Tapco plants requires inflammable liquids, and piping installations carrying in-

**Structural details, such as the method used to tie together the outer and inner courses of a masonry wall, may be important during maintenance work.**

flammables are of vital concern to insurance companies. Photographs of these installations are carefully labelled, dated, and witnessed so as to provide visual proof of how the hidden lines are installed, thus eliminating delays in construction work which might otherwise be required for inspections.

### Maintenance

Aside from these benefits, the progress photographs have yielded even greater dividends as an aid to maintenance work. Tapco's engineers repeatedly refer to these pictures — especially when complex piping systems hidden beneath the floor, in the wall, or buried in trenches are involved. Because of the nature of the work at this company, complicated piping arrangements are common.

Such installations are often difficult to visualize on engineering drawings, especially when symbols have been employed. Since it is impractical to show all the components of a crowded area in a single layout, structural members, conduit, and existing piping systems are often relegated to separate drawings. Photographs taken immediately prior to pouring the floor or covering the trench, on the other hand, will show all the components and locations of any obstructions.

Pictures taken during construction also can be relied upon to record details not specified in the plans. The routing of electrical wiring and most piping is not likely to be specified in layout drawings, and such details as the method of tie-in between the outer and inner courses of a masonry wall, or the straps used to anchor underground storage tanks, are not normally shown. Yet, such details are important when maintenance work must be done.

### Saving Time

Progress photos taken by Tapco engineers more than proved their worth during a recent alteration in underground facilities. The project involved the removal of two large storage tanks without interruption of service to two adjacent tanks. Time was a vital factor, and to make the project more difficult, a number of pipelines passed over the tanks.

Prints of pictures taken during the original installation were given to the contractor, along with the usual blueprints and specifications. Since the installation views enabled the contractor to immediately see what would be encountered, he was able to submit an estimate and begin excavation in much less time than would otherwise have been required. The photos also saved valuable time in locating and tracing the many pipes involved, since they eliminated the need for tediously searching the area with a pipe locator. During the actual work, the photos noticeably reduced the delays which inevitably occur while workmen consult the drawings and each other.

More recently, an expansion program involving a new building call-

**Photos taken before the floors are poured may save valuable time during emergency repairs by enabling engineers to see what will be encountered.**

Records of location, depth, and spacing of drainage lines help locate pipes during subsequent maintenance.

Photograph, showing a number of changes made in the field, aided draftsmen in revising original drawing.

ed for a duplication, in the new structure, of the same services provided to the adjacent building. This was to be accomplished by tapping into 24 underground pipes ranging from 2 inches to 6 inches in diameter. Twelve electrical conduits, located immediately above the pipelines, added to the problems of excavation.

Again, photographs taken during the original installation proved invaluable—both to the plant engineering department while planning the expansion, and to the contractor. Because the contractors could actually see the existing piping and electrical installations, as well as the extent and character of the original excavation, they were assured against unforeseen contingencies and were therefore confident in bidding much lower than they would have if only engineering drawings had been available.

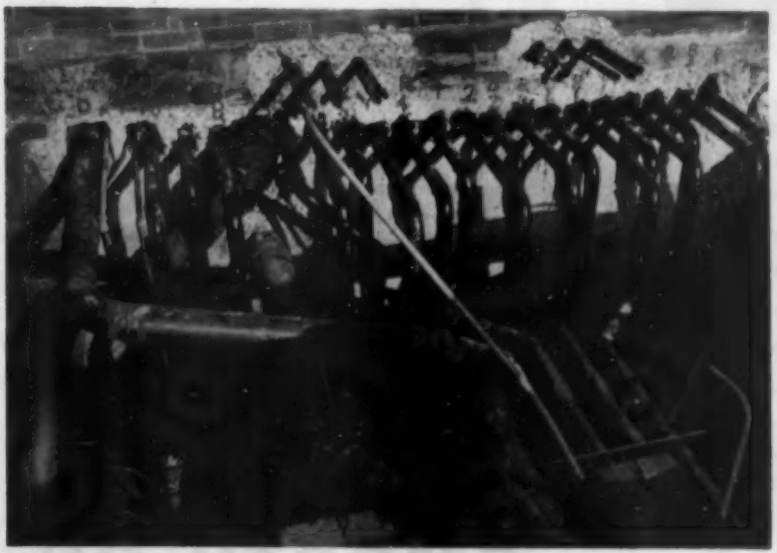
During excavation, the photos aided the contractor in tracing the pipelines, and also averted cutting into the conduits which were not specifically located on the original layout drawings.

### Continuous Records

To keep their records up-to-date, Tapco engineers photographically record all changes made to existing installations. The completeness of such a record has proved its worth many times in preventing serious errors from occurring during maintenance work because of failures to revise original layout drawings.

Enlarged prints, usually 5 x 7 inches or 8 x 10 inches, of all pictures showing the original installations and subsequent changes are carefully filed for quick reference. Identification of each picture is assured by careful labelling, together with notations of any layout drawings and written reports pertaining to the view.

Photographs of this type do not require special camera equipment or photographic training. Many of those being used by Thompson Products are taken by project engineers, using their personal equipment such as a small reflex or bellows-type camera using roll film, and simple flash equipment for taking indoor shots.



This view was used by plant engineering and the contractor when a duplication of services to a second building required tapping into each of these lines.

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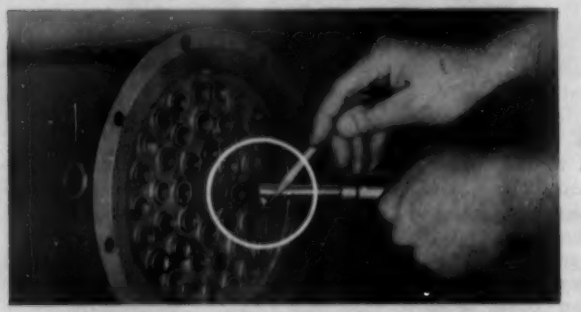

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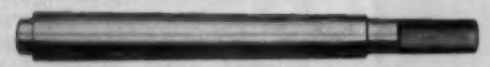

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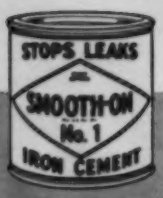


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Several drive selections can usually be made for a given application of silent chains. Such factors as life expectancy, space, speed, or cost, will dictate which drive is the proper selection.

The following design notes are intended as a guide in the selection of a satisfactory silent chain drive.

### Number of teeth in wheels

An odd number of teeth is recommended for the small wheel, or pinion. The recommended minimum is 17 teeth, but it is good practice to use 21 teeth or more for normal drive applications. For speed increasing drives, it is desirable to select a pinion with at least 23 teeth, and for high speed drives, pinions with 25 teeth or more should be used.

All steel pinions should have hardened teeth.

When space limits the diameter of the larger wheel, it may be necessary to select a smaller pitch, wider chain so that a pinion with an adequate number of teeth can be used.

It is well to select relatively large diameter wheels for 1:1 and 2:1 ratio drives. Sufficient diameter will assure a reasonable distance between the two spans of chain and will prevent them from striking after slack from normal joint wear has accumulated. This is of particular importance for drives operating on long, fixed centers with the slack span of chain on top.

### Chordal action

The chordal rise and fall of each chain pitch as it contacts a sprocket tooth is known as chordal action and results in repeated variations in linear chain speed. The amount of chordal movement and chain speed variation becomes progressively smaller as the number of teeth in the pinion is increased. Smoother operation and longer chain life may be obtained by selecting pinions with 21 or more teeth because chain joint articulation is reduced. Chordal action becomes negligible when 25 or more teeth are used.

### Quietness

Where quietness is essential, use a smaller pitch, wider chain than would otherwise be selected and a pinion with 25 teeth or more.

### Drive ratio

With proper engineering considerations, drives having ratios as great as 12:1 will perform satisfactorily; however, it is advisable to compare the cost of a single reduction drive with the cost of a compound drive where ratios larger than 8:1 are encountered.

Large reduction drives on minimum wheel centers are more economical if small pitch, wide chains are used. Small reduction drives on long wheel centers are more economical if larger pitch, narrow chains are used.

### Wheel centers

The distance between wheel centers must be great enough for the wheels to clear—more than ½ the sum of their pitch diameters.

Where ratios are 2:1 or greater, a center distance equal to the diameter of the large wheel plus ½ the diameter of the small wheel is recommended.

For larger reductions, the center distance should not be less than 0.8 of the difference in the diameters of the two wheels.

### Chain tension

Maximum chain life will be attained when centers are adjustable or provision is made to control chain tension. An initial adjustment of chain tension should be made after the first 50 to 150 hours of drive operation to remove the slack due to seating of the joint components.

Only occasional adjustments are necessary thereafter, the frequency being governed by operating conditions of the drive.

Care should be exercised in main-

**SILENT CHAIN DRIVE FORMULAS**

Symbols used in the formulas are:

C = Wheel centers, in inches
G = Excess chain, or the difference between arc AB and straight line AB, in inches.
H = Horsepower
N = Revolutions per minute
P = Chain pitch, in inches
q = Torque, in pound inches
Q = Torque, in pound feet
r = Pitch radius of wheel, in inches
S = Approximate chain sag, in inches
T = Number of teeth in wheel
V = Chain speed, in feet per inches
W = Working load, in pounds

The formulas are:

$$H = \frac{WV}{33000} = \frac{WPTN}{396000} = \frac{qN}{63000} = \frac{QN}{5250}$$

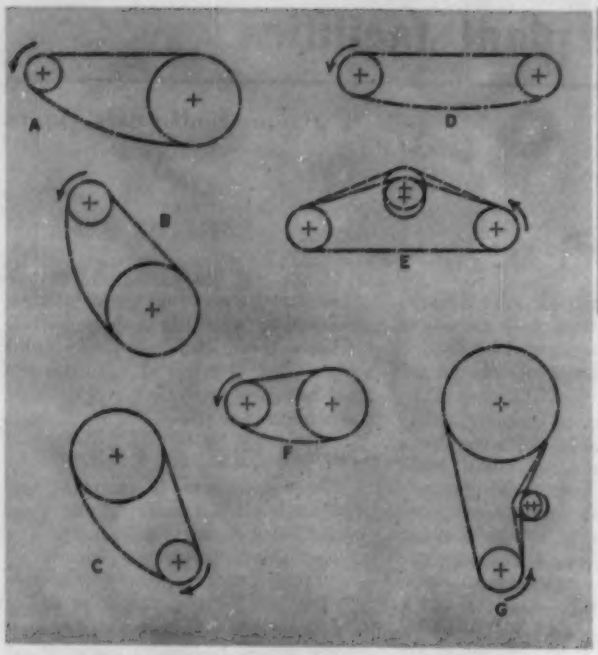
$$V = \frac{PTN}{12}$$

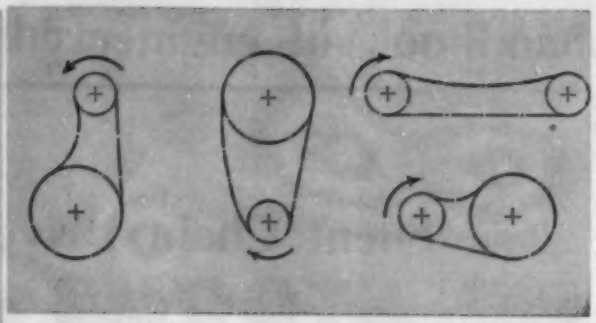
$$W = \frac{396000H}{PTN} = \frac{33000H}{V} = \frac{q}{r}$$

$$q = \frac{63000H}{N} = Wr$$

$$Q = \frac{5250H}{N} = \frac{Wr}{12}$$

$$S = \sqrt{.375GC}$$



**Desirable drive arrangements for silent chain are shown at left. Of this group A, B, and C can be operated with rotation in either direction. Some provision for adjusting centers to maintain tension is recommended. Four drives above can be used but are not recommended. Slack chain either causes sag away from lower wheel—or tends to strick lower chain or cause pitch if drives are horizontal.**

taining proper chain tension where the following operating conditions are encountered.

- ¶ Fixed centers.
- ¶ Vertical or near vertical centers.
- ¶ Shock or pulsating loads.
- ¶ Reversals in direction.

The simplest method of adjusting chain tension is to provide for adjustment of one of the shafts. This method is usually used for drives operating from electric motors or internal combustion engines. Adjustment of centers may be accomplished by mounting the driving equipment on an adjustable base plate or on slide rails.

Chain tension may be maintained in drives operating on fixed centers through the use of an automatic or manually adjusted idler wheel. Manually operated chain tensioners should be checked frequently. Idler wheels should have a minimum of 17 teeth and should be located adjacent to the driving wheel on the slack span so that a minimum of 3 teeth are in full engagement.

Another method of controlling chain tension is by the use of a hardened steel or hard wood shoe bearing against the back of the chain. This method is satisfactory for small horsepower drives operating on fixed centers at slow or moderate speeds with ample lubrication.

Offset couplers may be used to adjust chain tension or chain length when other means of adjustment are not available. This is done by removing a section of chain having one more pitch than the offset coupler and inserting the coupler.

It is only necessary to provide enough movement of the tensioning mechanism to take up an accumulative amount of chain slack equal to slightly more than two chain pitches. Additional movement is not required because, after maximum adjustment has been made, two pitches of chain can be removed and the tensioner relocated as before.

Adjustable shoes or idler wheels may also be used to provide proper chain wrap on the pinion of large ratio drives on short centers.

### Speed increasing drives

The faster running, small wheel should have at least 23 teeth and, if possible, the taut span of chain should be on top.

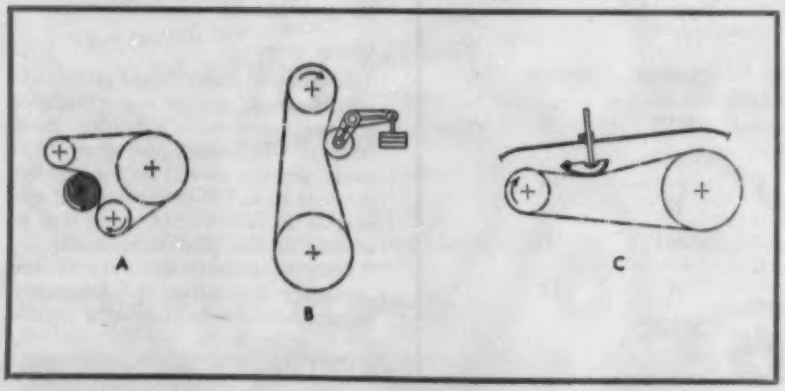
### Vertical wheel centers

For successful operation and normal life, a drive on vertical centers should be provided with some means of center adjustment or chain tensioning. This is particularly important when the small wheel is in the lower position.

### Fixed wheel centers

When centers cannot be made adjustable, make a conservative drive selection by using a greater service factor and the largest pitch practical.

**Adjustable idle wheels or shoes can be used to maintain tension of chain.**




*This data is excerpted from Link-Belt booklet "Silent Chain Drives," No. 2425. Complete book is available from Link-Belt Company, Chicago.*

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This plant is offered by the owners either for sale or for rent, with or without options. Or the owner will operate as supplier under contract.

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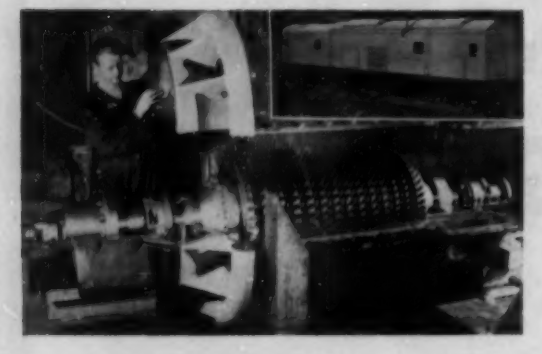
# spot news

**. . . what's happening in U. S. industrial plants**



## Railroad Car Contains Gas Turbine Power Plant

Of interest to the electrical power engineer is a compact Stal gas turbine power plant built into a railroad car to form a mobile emergency service unit for areas where electrical supply has failed. It can also be used during an overhaul or alteration of the regular supply.

The power plant consists of any open cycle gas turbine and a three phase generator, driven by the gas turbine via a gear box. After running speed is reached, the equipment is automatically controlled.

The car includes a machine room for the turbine and generator, an adjacent room for the 90 hp diesel starter engine, and a control room.

Rating of the plant is 2400 kw with 20 percent efficiency at full load.

Auxiliary motors and apparatus are fed with 380 v, 3-phase ac. This can be taken from the internal generator, the main generator via a transformer, or from an external network.

According to the manufacturers, Svenska Turbinfabriks A. B. Llungstrom, of Finsborg, Sweden, the plants operate economically with a gaseous fuel or a low grade fuel oil.

## Tests Show Dry Chemicals Safe for Electrical Motor Fires

For some years, fire protection experts have recognized the ability of dry chemical fire equipment to extinguish electrical fires quickly and economically, but some have hesitated to recommend it because of a belief that the chemical is abrasive and may damage electrical motors or other sensitive equipment.

Ansul Chemical Co. of Marinette, Wis. now reports that tests conducted by Power and Mine Supply Co., Ltd. of Canada tend to disprove this theory. For the tests, the contents of one four-pound dry chemical extinguisher were emptied into both end bells of a 7½ hp, 550 v dc motor while in operation. Armature fields, commutator, brushes, and all other parts were thoroughly covered with the chemical. The motor continued to operate, normal ventilation carrying off excess chemical. The motor was then stopped and the contents of another four-pound extinguisher were partially discharged into the motor. This time all ventilating slots in the armature were filled, the commutator was completely covered and the brush-holder packed with dry chemical. When the motor was again put into operation, it performed just as it had before the tests started.

When the motor finally was stopped, an air hose was used to blow the remaining dry chemical off and out of the motor including the ventilating slots.

Inspection showed no abrasive damage to the commutator but indicated that bearings needed relubrication. Motors using ball bearings apparently needed no further servicing than blowing out with the air line hose. On the other hand, for those motors using sleeve or roller bearings, it was recommended that the bearings be drained, flushed, and re-oiled or greased, and that the balance of the equipment be blown off.

E. H. Hawley, superintendent of the Western Elevator and Motor Co., Ltd., of Winnipeg, who provided the motor for the tests, examined the motor later. He said no damage had been done to the motor in any way, including the commutator.

To assist plants and industries with special fire hazard problems, Ansul Chemical Co. maintains at Marinette, Wis. a seven-acre fire test field, considered one of the best equipped fire extinguishing laboratories in the country.

## Belt Conveyor System Designed for Future Expansion

It is estimated that during 1954 at least two million tons of rich iron ore will be mined and shipped by Orinoco Mining Co., subsidiary of U. S. Steel Corp., from Cerro Bolivar, Venezuela's 1800 ft "mountain of ore."

Puerto Ordaz, at the confluence of the Caroni and Orinoco Rivers, and 91 miles from the mine, has been turned into a 6000 long-ton per hr capacity ore storage and loading station.

The ore handling system at Puerto Ordaz, furnished by Link-Belt Co. as prime contractor, includes facilities for dumping 67 railroad cars per hour, crushing it in primary and secondary crushers to minus five-inch size, and transporting it to a storage pile of 470,000-ton

# NICHOLSON TRAPS UP PRODUCTION at *Certain-teed* Plant

*Above, Certain-teed Products Corporation's Dallas, Texas, roofing plant, where Nicholson steam traps have been adopted as standard.*

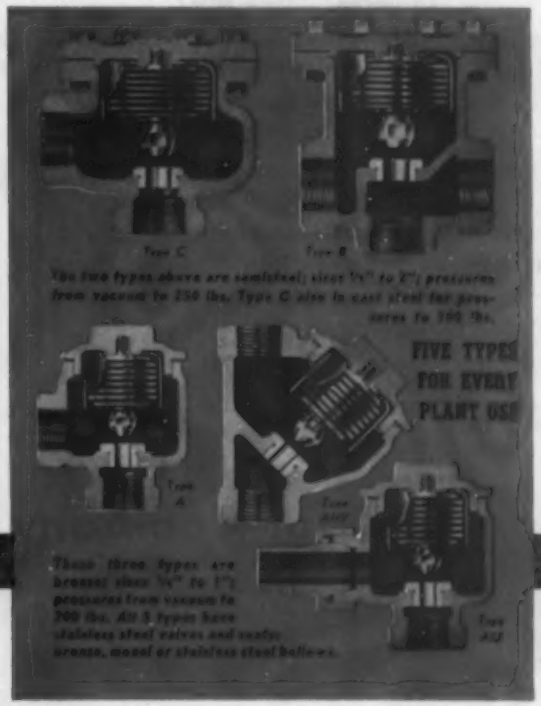
Why this modern Dallas, Tex., plant of Certain-teed Products Corporation has standardized on Nicholson steam traps may be important to you. It was because, as a plant official stated, "Nicholson traps have cut loss of steam and improved operations generally". More specifically, a recent survey showed these Nicholson features to be the reasons why leading plants are increasingly standardizing on Nicholson thermostatic traps:

(1) Two to six times average drainage capacity. (2) Operate at lower temperature differential. (3) No air binding. (4) Freeze-proof. (5) Only one moving part. (6) No need to change valves for varying pressures. (7) Record low for steam waste. Types for every process, power and heat application.

*Send for* **CATALOG 953**

Contains installation diagrams and data for determining proper size of trap.

*Nicholson traps on drying drums of asphalt saturator; Certain-teed's Dallas, Tex., plant.*

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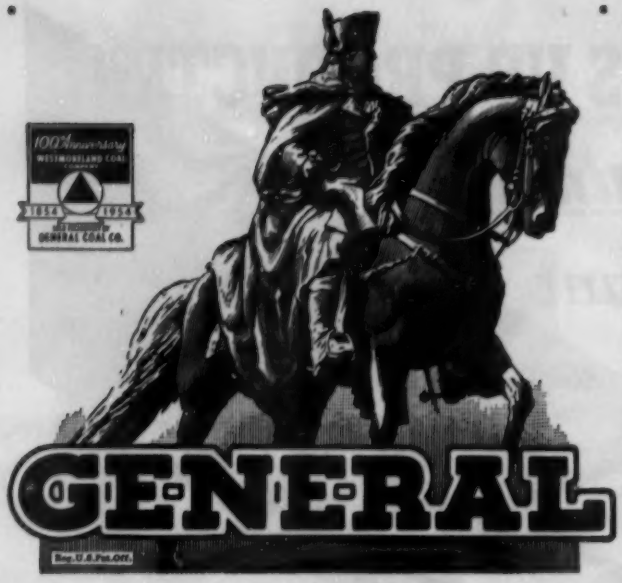


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# spot news

— Starts on page 90

capacity, where it is stocked out by means of a self-propelled, 400-ft-span belt conveyor bridge.

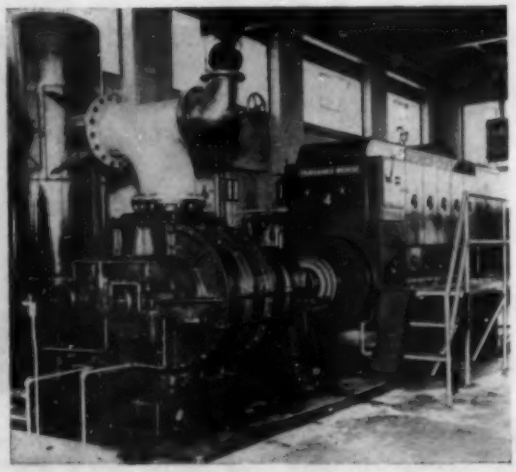
When a ship is to be loaded, the ore is reclaimed automatically by means of four traveling rotary plow feeders which are located in two tunnels beneath the storage pile, and transported by belt conveyor to the dock, weighed and sampled en route, and loaded into the hold of the ship.

The traveling shiploader which can serve vessels of up to 50,000-tons capacity, has a loading boom that can be raised or lowered to compensate for 39-ft seasonal rise and fall of the river level.

One man in the shiploader operating cab controls the speed and capacity of the entire reclaiming system, from storage pile to ship, by means of a variable voltage electrical hookup. This arrangement provides speed variations for trimming ship and reduces the cumulative delay resulting from starting and stopping the various units in sequence.

Provision has been made for increasing the capacity of the reclaim system to 12,000 long tons per hr through future installation of two additional tunnels beneath the stockpile, a duplicate conveyor system from storage pile to dock, and a second shiploader.

The design of the system was developed by Link-Belt in cooperation with Orinoco Mining Co. engineers. Subcontractors on the project were McDowell Co., S. A., of Caracas, who handled the erection, and Wellman Engineering Co., who built the car dumper, belt conveyor bridge, and shiploader. International General Electric Co. furnished the electrical controls, and Allis-Chalmers Manufacturing Co. furnished the crushers.



## Sewage Gas Engines Save Money and Assure Power

Installation of two 325 hp Fairbanks-Morse dual-fuel sewage gas engines is said to have given Lansing, Michigan's newly expanded sewage treatment plant a highly flexible, dependable, and economical power supply. In their first year of operation, the new engines saved

the plant $30,000 compared with the rate for an equivalent of purchased power. Each engine drives a 7000 cfm Roots Connersville blower. The engines normally operate on sewage gas with a small amount of diesel oil as pilot fuel but can operate wholly on oil when necessary.

In the course of the year there were about 50 occasions when the supply of sewage gas was insufficient for both diesels. The diesel put on full oil operation on these occasions produced 1000 cu ft of air for a fuel, lube, and maintenance cost of 4.5 mills compared with 10.5 mills for purchased power.

The thermal efficiency of sewage gas engines also is raised by the utilization of waste heat for sludge heatings, and at Lansing, a high proportion of the heat rejected by the engines is recovered for this purpose.

## Portable Conveyor Simplifies Materials Handling

Designed originally to meet the demands of an overcrowded steel plant for a small, light-weight conveyor to handle materials for rebuilding and for fast elimination of refuse, the SM all aluminum conveyor will hold up under hard usage according to the manufacturer, L. S. Farner Co., Pittsburgh, Pa.

Since the conveyors are braced crosswise, lengthwise, and built entirely of extruded aluminum, one man can rig-up a chain of these conveyors to move material in seconds through small openings, up or down steps, or through passageways which otherwise would be inaccessible. Powered by electric, gas, or an air motor, they will haul wet concrete, stone, brick, sand, flu dust, cinders, and refuse.

## Non-Chemical Boiler Cleaner Holds Solids in Suspension

Colloidal boiler-cleaning formulas have been successfully tested over a period of several years on more than 1200 boilers of various sizes and operating conditions according to the Water Treatment Company of America, Pittsburgh 12, Pa.

The new line, known as Series 31-H Formulas, consists of formulas which, when added to boiler water of various types, dissolve all forms of scale and corrosion,

*(Continued on page 110)*

**Both these SPECIALISTS help you operate efficiently, reduce wasteful spending**

No business would attempt to operate very long without the services of an accounting specialist.

And, no liquid handling program should be started without the guidance and recommendations of a WEINMAN Centrifugal Pump Specialist.

This man knows how to reduce your pumping costs by improving pumping efficiency and capacity. He can specify the right pumps for your needs with confidence, because that is his business — because his career and his success depend upon his ability to do so.

So, if you're considering the installation of new pumps, or the improvement of your present liquid handling system, call in a specialist . . . a WEINMAN Centrifugal Pump Specialist.

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speaks for itself

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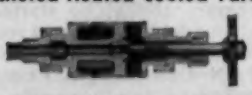
Rugged Jerguson OS&Y Valves are the ideal answer to meet high temperature or corrosive conditions where inside threads can't be tolerated. Efficient outside thread design eliminates possible freezing and allows the valve stem to work freely at all times.

**GA Valves for instrument piping and general use**

Tremendous time and cost savings are possible with Jerguson GA Valves. Threaded connections can be reduced from 10 to 3 . . . unions, nipples, reducers, elbows, tees, valve, and bleed valve are combined in one space saving unit.

**Jacketed Heated-Cooled Valves**



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# names make news

**. . . personalities from industry and power**

**Elliott Co.** — **S. K. Hostetter, Jr.,** sales manager of the Crocker-Wheeler Div. for the past year, is named general manager of the division.

**Darling Valve and Mfg. Co.** — **William H. Atcheson,** as a salesman for the Metal Products Div. will include in his territory the New York City area.

**Lunkenheimer Co.** — **Joseph A. Goller,** formerly foreman of the assembly department, is welcomed into the honorary Lunkenheimer Retired Supervisory Group, after 38 years of continuous service.

**Worthington Corp.** — **Fred J. Watt** is named manager of a newly combined section of the company's Air Conditioning and Refrigeration Div. at the Harrison, N. J. executive offices.

**Harnischfeger Corp.** has established a new division to handle sales of P&H electrical equipment. Head of the division will be **Oliver Fuller.**

**Link-Belt Co.** announces appointment of two new west coast sales managers: **Rodney F. Coltart** of the Central Pacific Div.; and **Benjamin M. Prestholt** of the Southern Pacific Div.

**General Electric Co.** — **Edward C. Clark** will co-ordinate G.E.'s activities in the use of gas turbines in various industries with particular emphasis on natural gas pipeline pumping.

**Hammel-Dahl Co.** announces the promotion of **John R. Curran** to director of engineering.

**Cleaver-Brooks Co.,** New York boiler sales office announces the addition to its staff of **Gilbert Foster,** sales engineer.

**Detroit Edison Co.** — This year's winners of the Alex Dow Award for outstanding achievement are: **Charles Einfeldt,** Piping Div. engineer; **J. Douglas Elliott,** Billing Dep't. Sup't.; **Karl J. Makinen,** general supervisor, relaying; **James E. Mulavey,** field engineer; and **Frank L. Taylor,** senior electrical apparatus engineer.

**Combustion Engineering, Inc.** announces appointment of **Robert L. Riker** as assistant to the president.

**American Locomotive Co.**—In line with Alco's continuing diversification program, **Martin Ettington** is appointed general manager of engineering in charge of all product engineering activities at the company's six plants.

**Marietta Concrete Corp.**—Appointment of sales representatives for its Industrial Silo Div. in four additional cities are announced: Mayer & Oswald, 37 W. Van Buren St., Chicago; Matt A. Doetsch Machine Co., 1625 I St., N. W., Washington 6, D. C.; Alcar Builders Specialties, Inc., 1315 Buttonwood St., Phila. 23, and Critz Engineering Co., 575 Wirham Pl., Cincinnati 20.

**Pangborn Corp.** — **Eric J. Fanton** and **Harry N. Patronik** join the engineering staff of the Dust Control Dep't.

**Orr & Sembower, Inc.** announces appointment of Ogle Engineering Sales, Louisville, Kentucky, as sales and service representative handling Powermaster packaged automatic boilers in central and western Kentucky. **Frank J. Ogle, Jr.** will be in charge.

**Wagner Electric Corporation's** Los Angeles branch office and warehouse is now in the new plant at 614 Lairport St. in El Segundo. **Carl Stevens** is manager of the automotive branch office, and **L. G. Tandberg** is manager of the electrical branch office.

**The Foxboro Co.** — Ground has been broken for a new branch factory to be

**Flood Control Project**

**Worthington Corp. plays host to engineering professors and instructors from N.Y.U., Columbia, Stevens Institute of Technology, Cooper Union, and Newark College of Engineering. Project shown is miniature of Bear Grass Creek with model of one of the 425,000 gpm pumps being built for the Louisville, Ky. location.**

erected at 399 Preda St., San Leandro, Calif. The new 8400 sq ft building will more than double the production area of the present San Francisco shop.

**American Viscose Corp.**, Sylvania Div. announces promotion of **Eugene W. Cornwell** to advisory engineer. **Edward L. Woolley** will succeed Cornwell as plant engineer of the local cellophane plant.

**Hagan Corp.** announces the retirement of **David J. Erickson**, president. He will continue to serve the company as a consultant. Newly elected president is **W. W. Hopwood.**

**Prat-Daniel Corp.**, Thermobloc Div., appoints **George F. Begoon** as director, Southeastern sales district with headquarters in Fort Lauderdale, Fla.

**Colonial Iron Works Co.** — Appointed as chief engineer is **Walter E. Schroeder.** He will be associated with **Dr. Donald Q. Kern**, director of engineering.

**Diamond Power Specialty Corp.** announces appointment of Graybar Electric Co., Inc., as national distributors of a new line of industrial television equipment soon to be in production.

**Federal Electric Products Co.** and its subsidiary, Pacific Electric Mfg. Co., announce appointment of **Don L. Orton** as North Central regional manager.

**General Electric Co. — Leslie E. Clover** is named manager of plant engineering and maintenance services in the G. E. Realty Corp.

**Clover** **Gaw**

**Western Precipitation Corp.** announces appointment of **Richard G. Gaw** as liaison engineer for application of the company's equipment to the steel industry.

**Universal Atlas Cement Co.—Fred T. Wiggins** is elected to the newly created office of vice president—commercial; **James C. McClure** to vice president and general sales manager; **Henry C. Schmielau**, currently comptroller, to the additional office of vice president. **Mac H. Hull** is appointed assistant to the president and **W. Owen Lawrence** is made general operating manager.

In the operating department **Archie H. Adams** is appointed plant manager of the Buffington, Indiana plant, and **Roald W. Nygaard** is appointed assistant plant manager, succeeding Adams.

**Elmer C. Martin** is now assistant to vice president, and **Harry T. Swanson** is named manager of the Atlas White Cement Bureau, succeeding Martin.

**Allis-Chalmers Mfg. Co.—J. W. McMullen**, general manager of the Pittsburgh Works is named vice president in charge of transformer and switchgear equipment.

**C. F. Kucera** and **Harold H. Ackmann** are appointed regional representatives for transmission equipment in the Southeast and Central regional offices, respectively, of the General Machinery Div.

**Nordberg Manufacturing Co.** — Special assistant to the president will be **Robert E. Friend**, formerly with Johns-Manville.

**Owens-Corning Fiberglas Corp.** — **Dan E. Morgenroth** is appointed manager of General Construction Materials Sales.

**Morgenroth** **Profita**

**Babcock & Wilcox — G. A. Profita** is named regional manager of the manufacturing department of the Boiler Div.

**Standard Pressed Steel Co.** moves up **Edwin Y. Bready, Charles A. Thomas, Jr.**, and **James L. MacDowell** in the ranks of top management. Bready becomes division manager of the Hallowell Pressed Steel Div. Thomas, manager of industrial relations and industrial engineering, has been given company-wide charge of production control, quality control, and estimating and cost analysis. MacDowell is advanced to superintendent of manufacturing, Fastener Div.

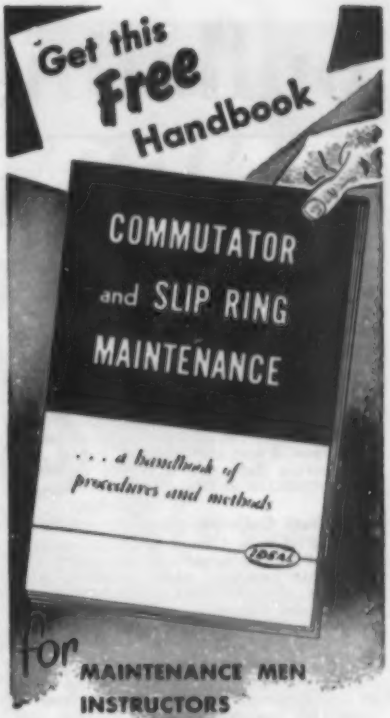
**Westinghouse Electric Corp.** — **C. B. Campbell** is appointed chief engineer for the South Philadelphia Steam Div.

In the sales organization of the Lamp Div., **Charles E. Erb** is named general sales manager; **Russell E. Ebersole**, marketing manager; and **Herbert E. Plishker**, merchandise mgr.

**Fairbanks, Morse & Co.** announces organization of a new Electronics Division. **L. J. Maguire** is appointed manager of the new division with offices in Davenport, Iowa.

**Anaconda Wire & Cable Co.** — **Jack Saunders** is named manager of a new Anaconda sales district to include all of the state of Florida. **Robert W. Carmichael** will work with him.

**Frank D. Dickey** is appointed manager of the San Francisco district. He succeeds **Lee Hayward**, who has resigned. **Dick Riley** will assist Dickey.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THE methods and procedures described were developed by recognized, practicing maintenance authorities. They have been proven by conclusive evidence over many years in hundreds of operations. A concise guide, this 39-page handbook tells the practical operating man everything he needs to know about:

- Commutator and slip ring troubles and how to correct them.
- Brush maintenance and operating procedure.
- General maintenance procedure.

Dozens of illustrations show the operations described. Condensed data on IDEAL commutator and slip ring products is included.

Even if you do not have a regular maintenance training program, your people responsible for motor and generator maintenance need, and will do a better job, with the help of this handbook.

*NOTE:* This offer is limited to those in plant and other industrial operations. We reserve right to limit quantities furnished. Offer may be withdrawn at any time.

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# bulletins

. . . for listing of the bulletins just received see page 36

## AIR CLEANING & DUST COLLECTION

**234—Small Scale Dehydration**

To meet the increased demand in engineering operations for small volumes of dry gases not warranting plant size installation, this company has developed the Hy-dryer, described in this seven-page booklet. Operation of the unit is explained by means of text and pictures. Tables give engineering data necessary for ordering. J. F. Pritchard & Co., Equipment Div.

**235—Dust Collectors and Arrestors**

Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

**237—Dust Collectors**

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

**238—Precipitation Equipment**

Engineers contemplating the installation of equipment for recovering dusts, fly ash, fumes, mists, fogs, or other similar suspensions in stack or process gases will find much valuable data in this 40 page booklet. Western Precipitation Corp.

**239—Dust and Fume Removal**

This 19-page bulletin, 610, pictures and describes the standard units that go to make up the Multi-Wash System for the removal of air-borne dust, fumes, vapors, and odors. Besides explaining the operation and advantages of each component of the system, the booklet includes many installation photographs. Bulletins are offered covering other equipment made by this company. Claude B. Schneible Co.

**241—Industrial Dusts**

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

## AIR CONDITIONING— HEATING & REFRIGERATION

**242—Temperature, Moisture Control**

Precision control of air temperature and moisture enable you to produce your product in any climate, at any season, according to six-page bulletin 122. The Type "A" air conditioner described, for drying or moistening of air, is shown in typical installation photographs. Niagara Blower Co.

**243—Propeller Fans**

Three new models are among the 13 types of fans shown in 40-page bulletin A-109. It also describes three types of roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all of the equipment plus valuable engineering data. Hartzell Propeller Fan Co.

**244—Woven Electric Heaters**

Pre-Fab woven electric heaters are described in folder 1548 which illustrates typical uses and gives application data for this versatile heat source. Suggested uses such as for heating gearboxes, local comfort heating, and for preventing condensation are listed along with application data. Pre-Fab Heater Co., Subsidiary of Edwin L. Wiegand Co.

## BOILERS & STEAM

**245—Vertical Unit Boiler**

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

**246—Feedwater Gas Analyzer**

Described in four-page folder 148BP is an analyzer for measuring dissolved oxygen and hydrogen in feedwater. Advantages, ranges, and accuracy are discussed. Cambridge Instrument Co., Inc.

**247—Refuse and Wood Burning**

Engineering data concerning spreader stokers installed to burn refuse or wood are contained in 24-page booklet 505. Stationary, manual dumping, power dumping, and traveling grate installations having maximum capacities from 10,000 to 275,000 lb steam per hr, steam or compressed air operated, are described. Detroit Stoker Co.

**248—Firebox Burners**

Firebox boilers are discussed in bulletin 702. This four-page pamphlet describes the principle features and presents a detailed chart of dimensions and capacities. Boilers are available from 13 to 61 hp. Johnston Bros., Inc.

**249—Boiler Controls**

Specifications for the fully automatic, all electric metering type packaged control for shop assembled boilers are given in four-page folder 53-1088-239. Schematic drawing shows a typical packaged control system for a combination oil and gas fired boiler. The Hays Corp.

**250—Liquid Level Gages**

Remote reading liquid level gages to protect boilers, deaerating tanks, feed water heaters, and storage tanks are described in eight-page bulletin 176. A typical schematic drawing of a steam boiler application shows the gage in use. Drawings also illustrate wall and panel mounting. Jerguson Gage & Valve Co.

**251—Pressure Equipment**

One of the Country's oldest manufacturers of equipment and accessories for plants piping steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. Wright-Austin Co.

**252—Boilers**

Self-contained boilers for heating and processing are described in seven-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

**253—Firing Equipment**

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included. Petro Division.

**254—Cyclonic Combustion**

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your Questions Are Answered by Cyclotherm." Descriptive

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drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

**255—Automatic Burner**

Newly designed automatic burner, model PK-54, for oil, gas, and oil or gas, is described in four-page folder 430. Safety features are listed and the unit's integrated design is explained. For capacities to 42,000 lb steam per hour, the burner is described as a complete, automatic combustion unit including burner, blower, and controls. Peabody Engineering Corp.

**256—Boiler Baffles**

"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in an area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

**257—Boiler Replacement**

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. Superior Combustion Industries, Inc.

**258—Packaged Steam Generators**

Basic construction and design features of plant assembled steam generators, with or without superheat, are presented in illustrated 20-page booklet P6-51-2. Includes tables of engineering specifications for units from 10,000 to 30,000 lb steam per hr and design pressures from 250 to 825 psi. Also includes section on control and instrumentation. Foster Wheeler Corp.

**259—General Catalog**

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in four-page folder. Steam generators, heat transfer equipment, pressure vessels, valves, and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

**260—Coal-Burning Installations**

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

**261—Boilers & Stokers**

Over 88 years experience are embodied in the design and construction of Scotch Marine type portable boilers says 28-page catalog. Advantages of this internally-fired, return-tubular boiler are thoroughly discussed. Photographs and cross-sections illustrate various models ranging in capacities from 6 hp up to 25 hp. Details and features of underfeed stokers designed especially for this type boiler are contained in separate section. The James Leffel & Co.

**262—Packaged Steam Generators**

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the


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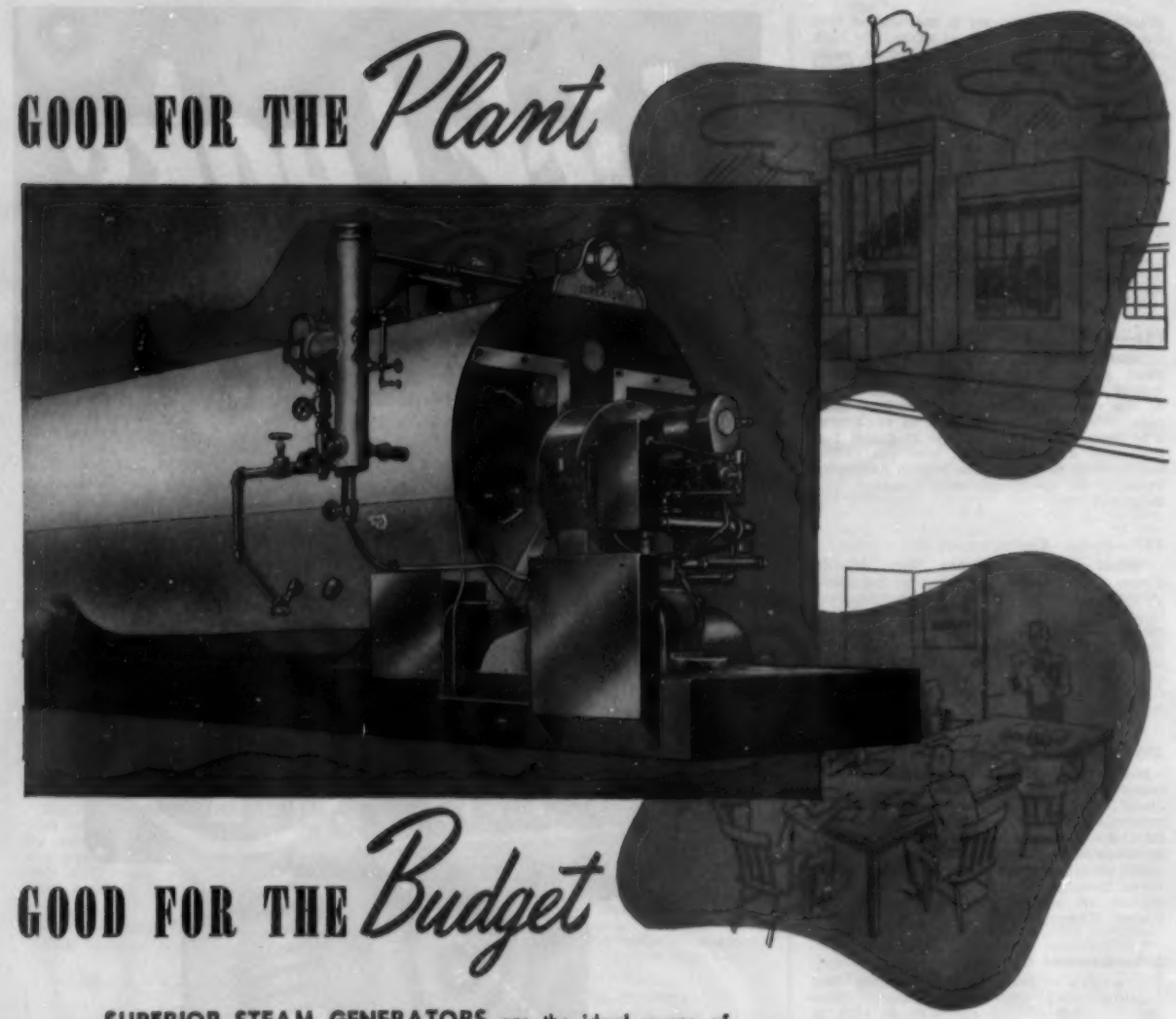
# GOOD FOR THE *Plant*



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Dependable, quiet performance, plus economies of installation and operation, make Superior the ideal steam plant.

*Fully automatic, Superior Steam Generators burn gas, oil, or both. Sizes from 20 to 600 bhp. for pressures to 250 psi. or for hot water. Battery installations provide maximum flexibility for higher capacities. Write for catalog 602.*

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**TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.**

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STEAM GENERATORS

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# readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 34/35 & 98/99

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# bulletins

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flexibility of design possible and dimensions. The Wickes Boiler Co.

### 263—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-53. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. L. J. Wing Mfg. Co.

### 264—Packaged Steam Generators

Construction of packaged steam generators is described in eight-page bulletin 1080. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

### 265—Off-Center Firing

Design features of a compact, automatic package boiler are discussed in four-page folder EC-1152. The theory of off-center firing, used with these units, is discussed. Specifications for units through 250 hp are tabulated. Dutton Boiler Div., Hapman-Dutton Co.

### 266—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

### 267—Oil & Gas Burner

Described in 16-page bulletin ID53-163 is a factory-coordinated, industrial fuel burning system. Built around an industrial burner for oil or gas firing, the system includes proper controls mounted in panels and wired to terminal strips for easy connection, factory engineered windbox and refractory ring, fuel oil heaters, and trim. York-Shipley, Inc.

### 268—Package Boilers

Automatic boilers for light oil, heavy oil, gas, or combination gas or oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. A cross-section shows components of system. Orr & Sembower, Inc.

### 269—Two Drum Packaged Boilers

Two-drum, bent tube package boilers for steam, and high pressure, high temperature hot water are discussed in a four-page folder. Ratings, data, and dimensions are given in table form. Springfield Boiler Co., Div. of John W. Hobbs Corp.

### 270—Water Tube Boilers

According to this eight-page publication, standardization of design has made possible the manufacture of a modern, compact, and efficient water tube boiler of two-drum design. Designs are available for oil burning or stoker feed as well as gas. Bulletin 49-1 "Two-Drum Type S Steam Generators." The Wickes Boiler Co.

### 271—Combustion Processes

Too much or too little air can have costly effects in combustion processes. Bulletin "Oxygen-Index of Combustion Processes" points out that by using oxygen itself as the criterion to proper combustion, greater over-all efficiency, and more economy can be realized. Sample point location and equipment requirements are discussed. Arnold O. Beckman, Inc.

### 272—Soot Blowers

Bulletin 1137 gives complete information on the Model G9B blower which employes a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests the various uses for boilers, superheaters, reheaters, economizers, heat exchangers, and oil stills. The blower described is available for three pressure ranges up to and including 1500 psi. Diamond Power Specialty Corp.

### 273—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ¾ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The publication describes various types of drills available. The Airetool Manufacturing Co.

### 274—Water Gages and Columns

How the Bi-Color water gage operates to show actual water level without transmission by mechanical, electrical, or hydrostatic means is explained in 23-page bulletin 1051. The many types of gages and their installation are pictured. High-low water alarms, soot blowers, and the "Utiliscope" wired television unit are also described. Diamond Power Specialty Corp.

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### 275—Spreader Stokers

Spreader stokers said to be adaptable to all types and makes of modern steam boilers and generators, from 5000 to 75,000 lb per hr steam output capacity, are described in 14-page brochure 800. Various installations using Roto-Stoker Type CC stokers of these capacities are highlighted by means of cross-sectional drawings. Detroit Stoker Co.

### 276—Water Tube Boilers

Packaged water tube Type H boilers, shop assembled, are described in four-page folder 3M. Capacities, dimensions, and weights are listed in tables. Drawings show various views and elevations. The Bigelow Co.

### 278—Unit Steam Generator

Design features of unit steam generators are discussed in 28-page booklet 2000. Illustrations supplement discussions. Data and dimensions of the units are listed. Capacities are listed from 600 to 20,700 lb steam per hr. Preferred Utilities Mfg. Corp.

### 279—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

### 280—Burners

The Roto-Press burner described in seven-page booklet 9101 is designed to meet the demand for maximum steam, automatic firing, minimum floor space, and elimination of high stacks. How to convert your standard rotary burner to a Roto-Press is explained. Combustion Equipment Div., Todd Shipyards Corp.

### 281—Liquid Level Indicator

Do you have to guess at your boiler water level? Nineteen-page booklet WG 1824 describes the Yarway Remote Liquid Level Indicator and shows how it is used not only for boiler water indication but for feed water and deaerating heaters, expansion tanks, hot flow softeners, and other similar uses. Wiring diagrams show control unit uses. Yarnall-Waring Co.

### 282—Boiler Cleaning

Four fact filled pamphlets explain how this company's products will help you solve algae problems, increase boiler efficiency with use of the Ever Clean boiler process, remove rust, and prevent corrosion. North American Mogul Products.

### 283—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustration. Fire protection valves are included. Everlasting Valve Co.

### 284—Forced Draft Air Registers

Available in a number of sizes to suit specific requirements, the forced draft air registers described in seven-page bulletin 9427 are for efficient combustion when burning fuel oil, natural, refinery, or manufactured gas, and for units burning oil or gas. Operation, design features, and advantages are discussed. Combustion Equipment Div., Todd Shipyards Corp.

### 285—Blow-Off Valves

Catalog 12-D1 features a redesigned line of blow-off valves with flanged or welding ends and bolted bonnets for 300, 400-600, 900-1500 lb sp classes plus the addition of welded bonnet blow-off valves with welding ends for 1500 and 2500 lb sp classes. Two pages are devoted to tips on selection, operation, and installation of blow-off valves. Edward Valves, Inc., subsidiary of Rockwell Manufacturing Co.

### 286—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of four-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

### 287—Boilers and Equipment

Sixteen-page bulletin SB-50, "Erie City Boilers and Allied Equipment," describes custom designed steam generators for central station or industrial application. A number of water tube types available as well as a line of fire tube waste heat units are pictured in cross section. Erie City Iron Works.

### 288—Automatic Combustion System

How the "Thermopack" Plan meets heating and power needs of those industrial and commercial plants capable of making oil burner or oil and gas burner installations on new and existing boilers with their own maintenance crews is described in six-page foldout 185. Preferred Utilities Mfg. Corp.

### 289—Boiler Selection

What to look for when you select a boiler is explained in six-page foldout BE3 by means of a phantom drawing of an automatic boiler. Typical installations are pictured along with photographs of units for light oil, heavy oil, gas, and combination gas-oil. Continental Boiler Div., Boiler Engineering & Supply Co.

### 290—Atomizing Oil Burners

The cheapest grades of oil or tar can be completely atomized and efficiently burned with Type SA steam atomizing oil burners according to 16-page bulletin 21. Models for various special uses are described. Furnace design and construction for efficient operation is stressed. National Airoil Burner Co., Inc.

## BUILDING MATERIALS & MAINTENANCE

### 291—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet, Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

### 292—Thread Compound

A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

### 293—Flooring

"Handbook of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with other materials for repairing floors. Flexrock Company.

### 294—Maintenance Book

"Genius at Work," is a handy booklet full of ideas for plant maintenance. This company has developed Kroll, a chemical for loosening frozen parts. Kano Labs.

## COMPRESSORS & BLOWERS

### 295—Compressors

Horizontal heavy duty air and gas compressors, Type T, are described in 15-page bulletin 728-8. Cross sections of crankshaft, inlet valve unloading system, compressor cylinder and valves, and the complete compressor add to the value of the booklet. Also included are brief descriptions of other arrangements. Chicago Pneumatic Tool Co.

## CORROSION CONTROL

### 296—Rubber Linings

Application of rubber lining to prevent corrosion of tanks, pipes and valves is discussed and illustrated in 4-page folder. In addition, a 2-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Manufacturing Co.

## DIESEL & GAS ENGINES

### 297—Dual Fuel Engines

In 36-page bulletin S-500-B87, are photographic examples of each application, together with vital statistics, case histories, and comments on fuel consumption for dual fuel engines. Each feature is treated separately: the dual plunger fuel injection pump; automatic fuel switcher; automatic thermal air control; and the Micrometering gas valve which accurately controls fuel supply to individual power cylinders. Worthington Corp.

### 298—Two-Cycle Diesels

Handy for filing and reference purposes, a series of data sheets gives condensed information and specifications on the full line of P & H two-cycle diesel engines. Each model or engine and power unit is pictured and discussed in a separate bulletin. All models, from 20 to 138 hp, 2, 3, 4, and 6 cylinders are included. Harnischfeger Corp., Diesel Div.

### 299—Exhaust Control

How catalytic exhaust systems remove noxious carbon monoxide and irritating hydrocarbon fumes from exhausts of internal combustion engines is explained in this four page folder. The new Dieseler exhaust which cuts smoke, odors, and CO content of 4-cycle diesel engines is also described. A graph compares CO content from equipment with and without this company's exhaust system. Oxy-Catalyst, Inc.

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## ELECTRICAL EQUIPMENT

### 300—Dry Type Transformers

How to use dry type transformers profitably in your plant is explained in folder DT 195 which also includes wiring diagrams. Acme Electric Corp.

### 301—Metal Clad Switchgear

The HV line of metal clad switchgear is described in bulletin 7004B. Advanced engineering, refined design, and quality construction are included in this line according to the bulletin. I-T-E Circuit Breaker Co.

### 302—Outdoor Service Equipment

Designed to make easier the selection of outdoor service equipment, 12-page bulletin 2016 combines descriptive data on all available standard equipment—service entrance, receptacle type, dual control, three-phase units. Typical assemblies of circuit breakers and the various enclosures are listed for each type of equipment. Heinemann Electric Co.

### 303—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

### 304—High Load Fuses

Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCB. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Bussmann Manufacturing Co.

AUTO-LITE
TEMPERATURE RECORDING...
Newly designed, Model "1000" Auto-Lite Recorder gives permanent proof of temperature behavior. • 6" clear reading chart; various standard ranges from minus 40°F. to plus 550°F. • 3 standard types; choice of 24-hr. or 7-day cycle. • Electric or mechanical chart drive. • With capillary tubing for remote reading. Priced from $49.50.
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# bulletins

—Starts on page 96

### 305—Renewable Fuses

Sixteen-page bulletin S-40 describes the Economy De-Lay renewable fuses which are said to give safe and dependable time-delay on overloads. For every requirement, these fuses have inexpensive links which are easily replaced. Economy Fuse & Manufacturing Co.

### 306—Communication Systems

This data kit describes low-cost communication networks which make it possible to talk from control points to plant and between plant sites. Ease of installation is described along with the many possible arrangements for specific needs. Farmers Engineering and Mfg. Co.

### 307—Flexible Conduit

Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. American Metal Hose Branch, American Brass Co.

### 308—Low Voltage Switchgear

Bulletin 6004 A is a 24-page guide to I-T-E low voltage switchgear. Illustrated with diagrams and photographs, booklet is full of information on features, switchgear components, applications, specifications, and construction data. It also describes extra services which are available to users of switchgear. I-T-E Circuit Breaker Co.

## ELECTRIC UTILIZATION

### 309—D-C Power Sources

D-c power sources and supplies are described in eight-page booklet B-1049. Mechanical and electrical specifications are given for the Nobratron. Sorensen and Company, Inc.

### 310—Motors

Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

### 311—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

### 312—Light Dimming Equipment

Light dimming equipment, available as packaged assemblies, is the subject of 12-page bulletin D651P. Described are units for different numbers of circuits requiring up to 2000 w each, and for various types of a-c operation. Wiring diagrams are included. The Superior Electric Co.

### 313—Motor Control Center

Savings in space and expense and improved performance is explained in 12-page bulletin 170. Electrical and constructional details of these groups of combination motor starters and their components are fully described. Size, rating, and ordering data are included. Arrow-Hart & Hegeman Electric Co.

## HEAT EXCHANGERS & WATER HEATERS

### 314—Temperature Control

A simple method of controlling the temperature of liquid or gas is explained in four-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Niagara Blower Co.

### 315—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

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### 316—Water Heaters

A streamlined system of heating water and process liquids quickly and at low cost is explained in this bulletin. The Instant Heater described eliminates the need for reducers. Cross-sectional drawings explain how the unit operates. Johnson Corp.

### 317—Instantaneous Heaters

Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heaters as compared to the indirect method heater are discussed, explained, and illustrated. Pick Manufacturing Co.

### 318—Cooling Towers

Quick reference list of available literature on line of cooling towers and auxiliary equipment is contained in 4-page folder 1.19.092A. Types of cooling towers include mechanical draft, package type and atmospheric. Auxiliary equipment includes fans, fan drives and throats, louvers, and spray nozzles. Gas and air treating and heat exchanger equipment also are listed. J. F. Pritchard & Co.

### 319—Heaters

Horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, as well as the low-flow design are each cataloged as to weights, dimensions, construction details, and capacities—with conversion tables, in 48-page catalog 18. The Patterson-Kelley Co., Inc.

### 320—Injection Water Heaters

Steam injection water heaters with the pressurizer piston for safe, quite, automatic control are described in four-page


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pamphlet WH12A. How the unit saves space, time, fuel, installation, and maintenance costs is explained. Specifications for the seven standard sizes—for both direct and accumulator application—are given in tables. Pick Manufacturing Co.

### 321—Deaerating Heater

Bulletin WC-112, four pages, describes a packaged deaerating heater, spray type, for the smaller steam generating plants. Vertical two-minute and horizontal ten-minute storage units are shown in cross section. Graver Water Conditioning Co.

### 322—Heat Exchanger

Widespread application of the Paracoil boiler water sample cooler No. 75 gives timely importance to pamphlet 110. In addition to the design specifications, a set of charts is included to determine cooling water flow rate for various sample temperatures. Additional features include typical piping hookups and detailed instructions on the installation and operation of the cooler. Davis Engineering Corp.

### 323—Unit Heaters

Catalog CUH 846-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." Three useful reference books. D. J. Murray Manufacturing Co.

### 324—Heat Exchangers

Bulletin 120 describes the operation of the Aero Heat Exchangers used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photographs. Niagara Blower Co.

## INSTRUMENTS & CONTROLS

### 325—Instrumentation

Illustrated eight-page booklet R-8, "Results," presents the case history of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is fully described. The Hays Corp.

### 326—Flow Meters

With an alarm control, the flow meters described in this bulletin have only three moving parts. How it operates to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

### 327—Temperature Regulators

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning and rinsing solutions. The Powers Regulator Co.

### 328—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 53-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces and also for sewage disposal plants. The Hays Corp.

### 329—Gages & Thermometers

Large variety of recording, dial indicating, transformer and freezer thermometers and pressure, vacuum and compound recording gages fully described and illustrated in eight-page bulletin G13C. Also four pages of operating instructions for recording gages, and complete price list. Electric Auto-Lite Co., Instrument & Gauge Div.

### 330—Electronic Controls

Industrial controls, non-indicating, non-recording for regulating simple processes which do not warrant use of the more complex and expensive instruments, are fully listed and described in 80-page catalog 8305-R. Representative applications suggest ways in which these controls may be used in your plant. Minneapolis Honeywell Regulator Co., Industrial Div.

### 331—Temperature Regulators

Recommended installations of temperature regulators for instantaneous water heaters, storage water heaters, and forced air heating systems are shown in three line drawings in four-page folder 1006. Cutaway diagram of a typical regulator with a description of construction is given. Spence Engineering Co., Inc.

## LUBRICATION

### 332—Lubricating Oil

Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17 for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

### 333—Force Feed Lubricator

Automatic force feed lubricator Model "94" described in 11-page booklet 94-C will pump against any steam or air pressure up to 1000 lb and will handle any grade of oil from the lightest mineral to the heaviest cylinder stock. Manzel Div. of Frontier Industries.

### 334—Oil Filters

'Filters and Purifiers for Oil Circulating Systems,' 16-page reprint from the magazine "Lubrication" for March, 1954, discusses the contaminants encountered with oils in service and the deterimental effects associated with them. Oil oxidation and extraneous matter is listed. Selection of equipment and maintenance of the various types is fully discussed and tied in with fields where oil conditioning equipment is a must. The Texas Co.

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### 335—Petroleum Products

Brief descriptions of the leading products this company produces for industrial use are given in folders A-2894 and A-2951. These products include hydraulic oils, metalworking coolants, heat transfer oils, and many others. Sun Oil Co.

### 336—Non-Fluid Oil

This instructive bulletin explains the uses and advantages of Non-Fluid Oil. According to this booklet, it cannot clog


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# bulletins

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fittings, it lubricates until entirely consumed, and will not separate under pressure. A free testing sample of the oil will be sent with the literature. New York & New Jersey Lubricant Co.

### 337—Oil Reclaimer

Subject of four-page folder R-247 is a self-contained, compact oil reclaimer for keeping industrial oils free from contaminants. In addition to describing how the process works, the bulletin suggests applications. The Hilliard Corp.

## METALS & WELDING

### 338—Steel Weldments

New close-tolerance machinery illustrated in this four-page folder makes it possible for this company to produce single components or complete assemblies to your plant's specification. Examples of equipment designed and engineered by this company are also given along with suggestions as to cast parts that can be replaced by fabricated steel weldments. The Foster Co.

### 339—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

## PIPING, VALVES, & SPECIALTIES

### 340—Flexible Metal Hose

For what purpose do you use flexible metal hose? Whatever your application, you will find valuable information about job tested and certified hose in catalog 500. Included are data on steel, stainless steel, monel, and bronze hose in sizes 1/3 to 36 in. ID. Atlantic Metal Hose Co.

### 341—Flexible Couplings

Flexible couplings which never require lubrication are shown in 19-page bulletin 1009. Valuable engineering data for each type of coupling are given in table form along with drawings and application recommendations. Two more tables give conversion data for varying or pulsating load and for horsepower to torque. Lovejoy Flexible Coupling Co.

### 342—Float Traps

If you are planning to install low, medium, or high pressure float or float and thermostatic traps, you will need this illustrated catalog sheet. According to the data sheet, once these valves are installed, there is no necessity for the breaking of any pipe connection for servicing. Hoffman Specialty Manufacturing Corp.

### 343—Trapping Practice

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

### 344—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications. Davis Regulator Co.

### 345—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating expansion joint application and principles. Flexonics Corp.

### 346—Valve Catalog

The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Company.

### 347—Pilot Operated Valves

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in four-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

### 348—Reducing Valves

Four-page folder 511-A lists actual small flow reducing valve capacities based on test data. Cross-sectional drawings show construction of the bronze and steel valves. Leslie Co.

### 349—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

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### 350—High and Low Pressure Valves

Catalog 10 describes List 980 and 990 valves. The 980 is for a pressure range of 2000 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress with extra-strong stem and wedge-gate connection. Chapman Valve Manufacturing Co.

### 351—Rubber Lined Valves

This bulletin on rubber lined gate and check valves uses cross-sectional drawings to describe operation and construction. The fully revolving double disc, parallel seat principle is explained along with other advantages. Darling Valve & Manufacturing Co.

### Torque Wrenches

Both inch-pound and foot-pound torquers are described in this complete 68-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept. IP, 22762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

### 352—Cast Steel Valves

Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc., subsidiary of Rockwell Mfg. Corp.

### 353—Pipe Hangers

This hanger catalog describes the complete line of adjustable pipe hangers and supports made by this company. Specifications, drawings and engineering data are included. Grinnell Company, Inc.

### 354—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, eliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

### 355—Steam Traps

Steam traps which vent air from steam units eight times faster than ordinary inverted bucket traps are described in four-page folder 1153. Complete buying information on these Super-Silvertop Heat-Kwik traps includes condensate capacities, sizes, weights, and prices. A short description of other products manufactured by the Steam Specialties Div. of this company is also given. V. D. Anderson Co.

### 356—Prefabricated Conduit System

Introduced in four-page folder 5210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The Ric-wiL Co.

### 357—Steam Traps and Specialties

Catalog 68G, 31 pages, describes and illustrates steam traps, strainers, regulating and reducing valves, separators, and vacuum and lifting traps. Included are applications, dimensions, and a handy steam properties table. Strong, Carlisle & Hammond Company.

### 358—Flexible Metal Hose

Engineering data and installation recommendations on three types of flexible metal hose for diesel use are given in eight-page bulletin EH-80. Corrugated steel exhaust and air-intake; steel interlocked exhaust and air-intake; braid-covered seamless corrugated for conveying air, fuel oil, lubricating oil, and water are types covered. The American Brass Co., American Metal Hose Branch.

### 359—Steam Trap Selection

To help engineers, maintenance men, and plant operating executives select steam traps, four-page bulletin 154 discusses the construction of the Super-Silvertop Steam Trap and gives complete tables of specifications as well as pressures, weights, and list prices. Booklet also covers Steel Series Steam Traps. The V. D. Anderson Co.

### 360—Relief Valves

Charts, diagrams, tables, and a number of examples of plant operating conditions are presented in bulletin 5300 as illustrations to show how to correctly select a Multiport Relief Valve. It tells how the unit can be used as a differential pressure spill-over valve or as a check valve in

closed steam, air, or gas systems, and also as a vacuum breaker. Cochrane Corp.

**361—Pipeline Heating**

Pipeline applications of Cairod tubular heaters in industry are shown in photographs and drawings in eight-page bulletin GEA-5095A. A comprehensive chart gives heat losses of various metals. General Electric Co.

**362—Separators & Purifiers**

Live steam, exhaust steam, air and gas, and receiver type separators, and steam purifiers and exhaust heads are described in 24-page catalog 500. Charts give pressure drop, steam capacity, and air capacity. Wright-Austin Co.

**363—Pipe Joint Compound**

With the literature on this waterproof sealer for pipe and joints carrying water or low-pressure steam, a sample of the compound will be sent. Key Company.

**364—Valve Reseating**

Don't junk leaky valves — reseat them. Four-page folder describes a complete tool kit that will enable maintenance men to do the job themselves, quickly and accurately. Other time-saving, money-saving, reseating tools are also illustrated. M. B. Skinner Co.

**365—Chemical-Resistant Gaskets**

Gaskets made of Teflon for chemical-resistant service are described in bulletin TG-953. Among the types listed are Teflon-jacketed gaskets with various types of fillers, molded Teflon Snap-on gaskets, and Teflon-jacketed adaptors. United States Gasket Co.

**236—Rubber Linings**

Application of rubber lining to prevent corrosion of tanks, pipes and valves is discussed and illustrated in 4-page folder. In addition, a 2-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Manufacturing Co.

**240—Separator Catalog**

Instead of working out long equations and formulas you can, with the help of four-page bulletin 201, look at a graph and decide the size Hi-eF Purifier to meet your operating conditions. Specifications and applications of these line-type purifiers are also given. V. D. Anderson Co.

**277—Steam Trap**

The Drainator steam trap with no moving parts is described in this illustrated bulletin. Advantages, such as the fluctuating gage glass which signals when the trap is functioning properly, are discussed. Coe Manufacturing Co.

**409—Piping Layout**

How to plan an industrial waste treatment system is described in "Piping Layout No. 70." The booklet includes diagrams, specifications, and other detailed engineering data. Jenkins Brothers.

## POWER TRANSMISSIONS—MECHANICAL

**366—V-Belts**

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

**367—Eddy-Current Machinery**

"Basic Principles of Eddy-Current Machinery," a section of 18-page bulletin GBI, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives and couplings. Dynamatic Corp.

**368—Belt Conveyor Design**

Engineering data required to design a belt conveyor for any application are presented in 96-page catalog 852. The booklet, published to serve as a handbook on conveyor design, states that many problems can be answered by using a standardized unit. The Jeffrey Mfg. Co.

**369—Rayon Belting**

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163W. Uses and advantages of Thor belting are listed. Goodyear Tire & Rubber Co.

**370—Holdbacks**

How to protect and conserve valuable conveyor belts and safeguard operating personnel with simple inexpensive accessories is explained in four-page pamphlet 651. Photographs show operation of a roller type, instant acting holdback and of a belt cleaner. Drawings illustrate typical mounting arrangements for springtype cleaners. Stephens-Adamson Mfg. Co.

**371—Silent Chain**

One of the most comprehensive books developed on silent chain, 80-page bulletin 2433 contains detailed engineering data. Pre-engineered stock drives for normal requirements are listed. A complete section outlines selection procedure. Complete operational and technical data, such as installation, maintenance, and lubrication procedures, are described. Link-Belt Co.

**372—Power Transmission**

"Power Transmission Equipment," 32-page catalog 118, discusses variable speed pulleys, wide V-belts, sheaves, motor bases, countershafts, and Select-O-Speed transmission. Much more than just a catalog giving specifications, this literature presents representative applications for each unit and engineering drawings. Lovejoy Flexible Coupling Co.

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**373—Four-Rope Buckets**

Users of overhead or bridge type cranes with four-rope bucket trolleys will be interested in 44-page bulletin 2393. In addition to discussions and illustrations of buckets, reeving and sheave bearings, the booklet also presents information on methods of selection and uses of the equipment. Blaw-Knox Co., Blaw-Knox Div.

**374—Steel Collars**

Steel shaft collars are shown in use on industrial lift trucks, printing presses,


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# bulletins

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textile machinery, and other industrial equipment. Advantages of this type of collar are listed and a specification table is included. Standard Pressed Steel Co.

## PUMPS

### 375—General Catalog

Equipment for buildings and institutions is the subject of 20-page bulletin WP-1099-B27M. Condensed information is provided on such equipment as air conditioning and refrigeration products; oil, gas and dual fuel engines; deaerators and deaerating heaters. Worthington Corp.

### 376—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. DeLaval Steam Turbine Co.

### 377—Rotary Gear Pumps

"How to Solve Pumping Problems," is the title of 36-page booklet 3060. In addition to presenting typical problems and their solutions, various types of rotary gear pumps are described. The major portion of the book is intended to serve as a data handbook. Nomographs of friction loss in pipe, resistance of valves and fittings, and viscosity of oils are included. Geo. D. Roper Corp.

### 378—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. How these units decrease maintenance and lower operating costs is described. Darling Valve & Mfg. Co.

### 379—Proportioning Pump

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52R. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Hills-McCanna Co.

### 380—Non-Clogging Pumps

Type U non-clogging pumps designed for handling liquids carrying large amounts of solids and foreign materials are described in 11-page bulletin 730-C. The specific uses of each type pump are given along with tables to help in selection. Cross-sectional drawings are used to present special features of different types. Weinman Pump Manufacturing Co.

### 381—Vertical Pumps

"Vertical Pumps for Volatile Fluids," six page folder 1036, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves also are included. Johnston Pump Co.

### 382—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

### 383—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

### 384—Chemical Feeders

Install Series 30-T chemical feeder on your boiler feed-water pumps and you can forget troubles due to guesswork, inaccuracy or forgetfulness according to four-page folder 5M. Units for every requirement are pictured. Flow diagrams explain operation and advantages. Manzel Div. of Frontier Industries.

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### 385—Pump Package Systems

This catalog describes pump package systems including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gal complete with all accessories. The Manajust Stroke adjustment for varying capacity when pump is not operating, and the Autajust for precise control of flow while pump is running are explained. Orchem Pump Div.

### 386—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Co., Div. of New York Air Brake Co.

### 387—Package Feeder

Proportioning pumps and package chemical feeding units are described in this four-page folder. With liquid ends available for about 85 percent of all chemical pumping requirements, the pump is designed for use where a controlled capacity of fluid is necessary. How the feeding unit can be connected to the piping of your plant and to the electrical control equipment is explained. Bird-Archer Co.

## REFRACTORIES & INSULATION

### 388—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and results. Babcock and Wilcox Co., Refractories Div.

### 389—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville Corp.

### 390—Refractories & Insulation

Catalogs R-52 through L-03, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use

various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

**391—Heat Resistant Concrete**

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

## TURBINES & STEAM ENGINES

**392—Steam Turbines**

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the Type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Worthington Corp.

**393—Muti-Stage Turbines**

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diaphragms, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

**394—Steam Turbine Selection**

Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size for individual needs is explained. Coppus Engineering Corp.

**395—Steam Turbines**

If you use steam for heating, cooking, or processing, you can get power at almost no cost with the use of a Wing steam turbine according to bulletin SW-1a. Construction of these units gives an almost infinite range of speeds, easy control by throttling, and the units are independent of any electric power failure. L. J. Wing Mfg. Co.

**TO REQUEST FREE BULLETINS**

Circle "key" numbers on Reply Card between pages 34/35 & 98/99. Your requests will be handled promptly.

**396—Mechanical Drive Turbines**

Full details on this company's mechanical drive turbines are presented in a fully illustrated bulletin. These units are described as standard turbines, but "tailor-made" to your requirements. How they can be adapted to practically any operating condition or service is explained. Elliott Co., Steam Turbine Dept.

## WASTE DISPOSAL

**397—Waste Treatment**

How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in six-page booklet 70-B. Cross-sections show the various types of chemical and biological treatment equipment. A handy bibliography serves as a reference for more information on waste treatment in each of the industries covered. Infilco, Inc.

**410—Chemical Flocculation**

Chemical flocculation conveying and mixing equipment for use in water, sewage, and industrial waste treatment plants is described in 8-page booklet 2442. Installation photographs show many types of conveying and elevating equipment for economical handling of bulk or packaged chemicals. Flash and straight line mechanical mixers are described in detail and inserts contain general arrangement drawings and specifications. Tested layouts and selection tables to aid in determining tank size for required circulation flow are included. Link-Belt Co.

## WATER TREATMENT

**398—Water Analysis**

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

**399—Water Purification**

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, color process chemical softeners, and demineralizing units, including


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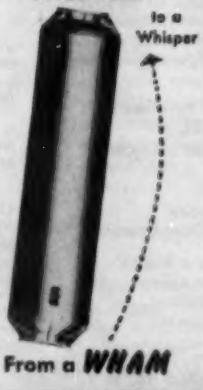


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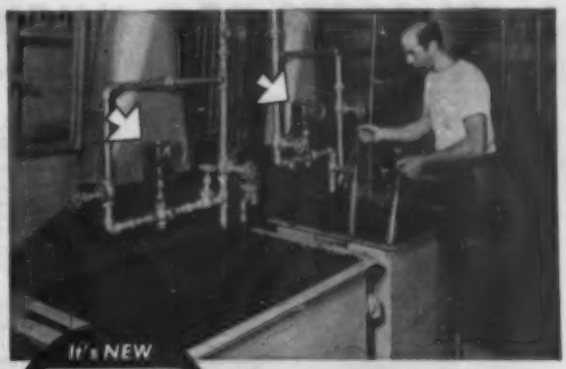

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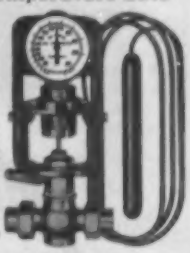
**Bulletin 330** fully describes this simple, self-operating regulator. (1560)



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# bulletins

—Starts on page 98

silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Hungerford & Terry, Inc.

### 400—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 87. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various conditions. National Aluminate Corp.

### 401—Boiler Water Foam

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

### 402—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, Zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin-Refinite Div. of Elgin Softener Corp.

### 403—Ion Exchanger

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

### 404—Deaerator

Bulletin 4643 contains complete details of a high efficiency deaeration unit for small and medium size power plants. Various types of installations are described along with the accessories necessary. Cochrane Corp.

### 405—Ion Exchangers

This 14-page booklet reviews generally the subject of ion exchange, established and potential applications. It gives advantages of the synthetic ion exchange resins and a bibliography of pages concerning their use. Rohm & Haas Co.

### 406—Water Softener

ZEO-FLO Sodium Zeolite Softener, a water softener specially designed for small and medium size industrial plants, laundries, and hospitals, is described in four-page folder 4505-A. How the softener has been simplified so that installation may be handled readily by the facilities of a small or medium sized plant is explained. Cochrane Corp.

### 407—Water Treatment Samples

"Industrial Water Treatment and Engineering Service," tells of the five basic lines of defense to guard against difficulties in water and steam cycles. A two-page diagram shows a water and steam cycle power plant layout and indicates the usual test required on samples taken at given points. Dearborn Chemical Co.

### 408—Water Treatment

"If You Use Water," 24-page booklet IE-9, discusses the more than a dozen important water treatment processes now serving industry—variations, how they work, equipment required, and type of water produced. Advantages of various methods are interpreted in terms of application to specific industries. Rohm & Haas Co., Resinous Products Div.

### 411—pH Control

"Automatic pH Control in Water and Industrial Waste Treatment," 8-page booklet, is a reissue of a paper delivered by R. T. Sheen, president of this company. Outlined are several typical systems of automatic pH control in boiler feed water treatment, using air- and motor-operated valves as well as controlled volume pumps to effect proper addition of chemicals. Diagrams of actual installations illustrate the bulletin. Milton Roy Co.

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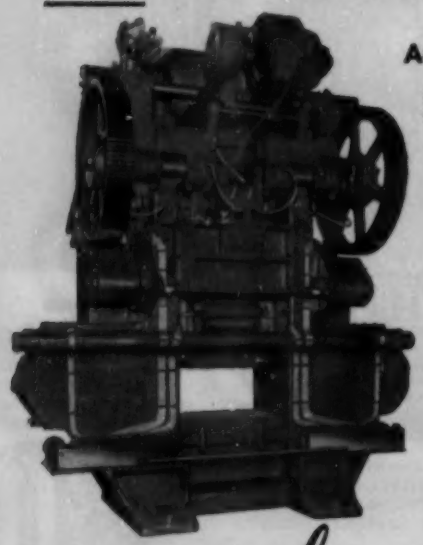

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### 412—Water Sampling

Are you sure you know the which, when, and where of obtaining samples for proper control of water conditions in your power plant? "Effective Water Sampling," folder 2RX7960, gives concise information on each phase of water sampling. Allis-Chalmers Manufacturing Co.

### 413—Chlorinizers

Chlorination—the modern way to prevent slime buildup in condensers and heat exchangers—saves you money if its right. But if dosage is too heavy, you run the risk of corrosion, according to application memo 840-J9. Chlorinizers available in three volumetric models for feeding from a few pounds to 6000 pounds per day are described. Builders-Providence, Inc.

### 414—Water Softening

Bulletin WC-106, 12 pages, explains the distinction between the sodium and hydrogen cycle, and shows differences in results obtained by the two processes. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. A simple method of sizing such softeners and a table of recommended flow rate aids are given. Graver Water Conditioning Co.

### 415—Boiler Water Treatment

Difficulties caused through industrial water contamination are outlined in a 12-page catalog. Recommended water conditioning treatments for scale, sludge, corrosion, carryover and other boiler conditions, and efficient control methods are described. Details on a system of complete boiler water conditioning are fully explained. E. F. Drew & Co., Inc.

### 416—Deaerators

Spray-atomizing type units are shown in cross-section in four-page booklet 400. Function, design and operation, construction, outstanding features, and uses are discussed. American Water Softener Co.

# books & films

. . . of special interest

AN INTRODUCTION TO POWER SYSTEM ANALYSIS, by Frederick S. Rothe; John Wiley and Sons, Inc., 243 pages, $5.00.

This book provides the fundamental mathematics required for the solution of problems involving power systems under normal and fault conditions. The mathematics of each of the following components are considered separately: the transformer, the generator, the transmission line, and the combination of these separate components under various load and fault conditions. Sufficient explanation is provided so the book can serve as a text to teach the fundamental mathematical relations. Because of its conciseness it may be used as a reference for the mathematical relations when they are needed.

Sufficient numerical examples are included to illustrate the application of the mathematical relations to practical problems.

Equivalent circuits in general and the common equivalent circuits used for transformers are described. This is followed by the fundamentals of symmetrical components and their equivalent circuits, plus the mathematical relations and the equivalent circuits for synchronous and induction machines.

Relations are obtained for sudden application of faults and suddenly applied system loads.

The mathematics involved in determining the sequence impedances of overhead transmission lines are presented together with their derivations. Separate chapters are included on steady-state transmission line theory and the fundamentals of power system stability.

The usefulness of the book is increased by its conciseness in presenting the mathematical relations. The material is presented in a simple, straightforward manner. It provides a general view of the overall problems of current and voltage relations in power systems, together with the mathematics necessary for the solution of the basic problems usually encountered.

## ALSO AVAILABLE

EQUIVALENT VALVES, Rev. Ed., Equivalent Valves Co., 170 pages, $19.75. This loose-leaf manual compares valves of 20 leading manufacturers by material, type, size, pressure rating, and structural variations. Revision sets will be furnished to present manual holders for $10.00.

INTRODUCTORY CIRCUIT THEORY, by Ernst A. Guillemin, John Wiley & Son, Inc., 550 pages, $8.50. Methods of steady-state and transient circuit analysis, as well as the basic concepts essential to synthesis procedures are presented in this book. It provides the tools and concepts, graphical interpretations, and computational aids necessary for the understanding of advanced research in network theory.

THE MEANING OF THE CONGRESSIONAL HEARINGS ON ATOMIC ENERGY, Atomic Industrial Forum, 80 pages, $1.00. This is a report of a panel discussion by seven experts from industry, labor, science, and the legal profession.

ELEMENTS OF HEAT TREATMENT, by George M. Enos and William E. Fontain, 286 pages, $5.00. For such users as mechanical and design engineers, it provides a practical background in metals and alloys. Their properties are covered, and an explanation given of how they are tested and evaluated. The discussions of the major processes—annealing, hardening, tempering, and normalizing—are treated from the standpoint of specific jobs that require given characteristics in a metal.

1953 REPORT ON OIL AND GAS ENGINE POWER COSTS, American Society of Mechanical Engineers, 37 pages, $2.50 ($2.00 for ASME members). The 25th successive annual report, this book contains data on 137 different plants. The material is broken up into three tables: Plant Cost Table; Cost by Years, for plants reporting for successive years; and Detailed Operating Information.

BULLETIN XIV, Acoustical Materials Association, 50¢. This annual publication of the association contains technical data on acoustical materials manufactured by member companys. Summary tables list products of the same general appearance and composition and the producers' tables have been rearranged for easier reference. Flame resistance test data are given on most of the products.

## INDUSTRIAL FILMS

"THE SCIENCE OF MAKING BRASS," 16 mm, sound and color, 29 minutes, Chase Brass & Copper Co., Waterbury 20, Conn. Modern production and quality control techniques are shown in sequences taken in the Chase research laboratories. The film makes use of animation, diagrams, and close-up shots of the casting, extrusion, drawing, and rolling processes used in the manufacture of sheet, rod, wire, and tube.


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**POWER PLANT ENGINEERING**

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*by Frederick T. Morse, Professor of Mechanical Engineering, University of Virginia*

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THERE IS NEW material on gas turbines, the fundamentals of nuclear energy, boilers, turbines, and condensers. Problems of the operating engineer, including tests and identifying sources of difficulties, are more thoroughly covered and throughout the book engineering principles of power plants and their operations, as well as design, are featured. Every consulting engineer and plant operator will find this treatment of the recent trends and theories in the field of power generation invaluable.

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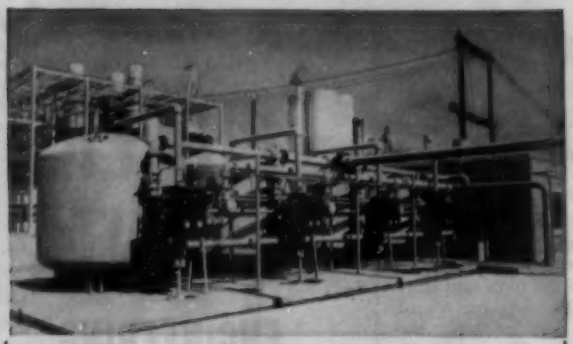

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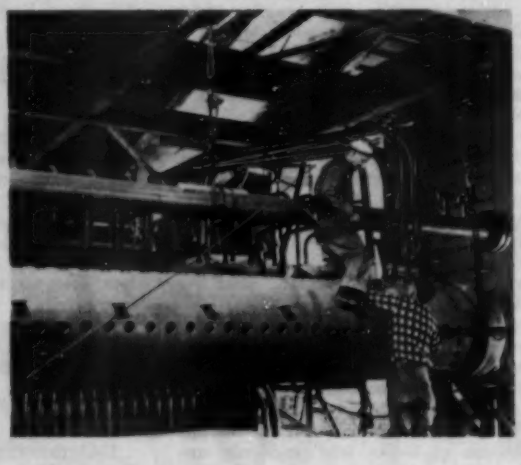
# spot news

— Starts on page 90

oil and grease and hold resulting solid particles in suspension for removal by blow down. Mud and sludge are carried off by this method rather than deposited and normal boiler operation is not disturbed. Experiments in actual installations are said to have shown that most boilers can be cleaned thoroughly in from 30 to 40 days.

The cleaning is said to extend beyond the boiler also, since the formulas blend with the boiler water and clean wherever the boiler water or steam travels.



## Boiler Burns Waste Liquor

Additional steam generating capacity plus the recovery of costly manufacturing chemicals are the money-saving highlights of a black liquor recovery boiler being installed at the International Falls mill of the Minnesota and Ontario Paper Co.

The boiler will recover chemicals by burning the waste liquor formed by the pulp making process. Heat from the burning process will be used to generate steam.

With the completion of the new Combustion Engineering, Inc. recovery boiler, the mill will have two such boilers. The first unit, with a capacity to handle liquor resulting from 125 tons of pulp a day, can be used either for the burning of waste liquor or for augmenting mill steam boilers. The new unit will have a capacity of 150 tons a day.

## Plastic Pipe Proves Itself Again

Pipe made from Kralastic, a synthetic resin-rubber plastic produced by Naugatuck Chemical Div., United States Rubber Co., has replaced copper and galvanized iron pipe in the plant operated by Grant Burleigh, Culligan Soft Water Service, of Winona, Minn. It was installed in half the time required for metal, was less than the cost of copper, and about equal in cost to galvanized iron.

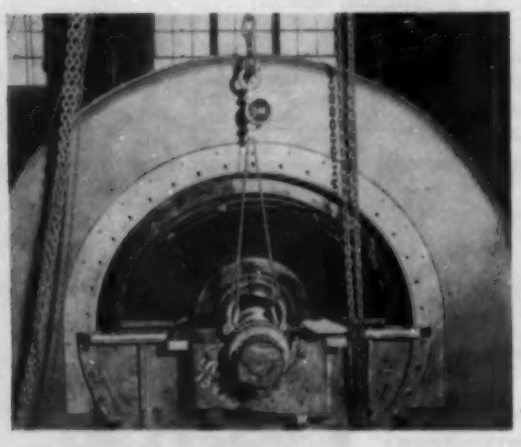
The copper or galvanized iron pipe previously used

in the Winona service unit was corroded by the brine solution or affected by electrolytic action.

Installation of the plastic pipe, made by Anesite, Inc., of Chicago, in a compact layout mounted on a wall panel, was simplified through the use of solvent welded fittings. The fittings, made by Tenco, Inc., of St. Paul, Minn. were used to join plastic to plastic, and also plastic to metal. The latter fittings were used to join the pipe to brass gages used in the unit.

## Transformer Acts As Its Own Oven

As part of the manufacturing process, transformers usually are placed in ovens to dry out, and finally are vacuum-treated to remove all trace of moisture. But in spite of the hugeness of these ovens, the 309-ton Atomic Energy Commission unit—which has tap-changing under load—was too big. The solution was to make the transformer act as its own oven and, later, as its own pressure vessel. Westinghouse Transformer Div. engineers introduced 221 F air at the bottom of the transformer and exhausted it out the top. Later, the transformer tank was "bottled up" and served as its own pressure container while being vacuum-treated. The complete air-drying operation took six days.



## Bearings Aligned With Dynamometer

Aligning generator bearings by means of a dynamometer, a system developed by the General Electric Co. at West Lynn, Mass., is said to save considerable time over the older method of lining up bearings by measuring down from a tight line over the top of the generator.

For the three-bearings unit in the photograph, the shaft of the number 3 bearing is supported by a crane. With the dynamometer between the crane hook and the journal, the journal can be set at a point where it is carrying the desired load on the bearing. The W. C. Dillon & Co. dynamometer, used here, indicates the load directly in pounds. Similar checks on the other two bearings are unnecessary, as they will carry their calculated load once the original bearing has been properly set.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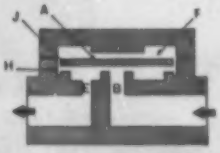


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Air and/or condensate raise valve seat disc A, discharge thru E. When steam follows, greater velocity causes it to strike body at H thus building up pressure in chamber F. This causes disc to seat, closing tube B. As pressure in F decreases by condensation and leakage thru slot J, pressure in tube B raises disc and cycle is repeated.

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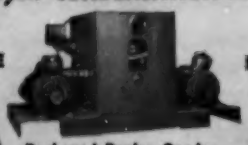

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# meetings

## . . . and exhibitions

| | | |
|---|---|---|
| June 9-12 | National Society of Professional Engineers (20th Annual Meeting) | Hotel Schroeder Milwaukee, Wis. |
| June 14-17 | American Society of Mechanical Engineers (Oil and Gas Power Div.) | Muehlebach Kansas City, Mo. |
| June 20-24 | American Society of Mechanical Engineers (Semiannual Meeting) | Wm. Penn Pittsburgh, Pa. |
| June 20-25 | American Institute of Chemical Engineers (Conf. on Nuclear Engr.) | University of Mich. Ann Arbor, Mich. |
| June 21-25 | American Institute of Electrical Engineers (Summer General Meeting) | Los Angeles, Calif. |
| June 28-30 | American Society of Heating & Ventilating Engineers (Semiannual Meeting) | New Ocean House Swampscott, Mass. |
| July 13-15 | Western Plant Maintenance Show (Conference & Expos.) | Pan Pacific Bldg. Los Angeles, Calif. |


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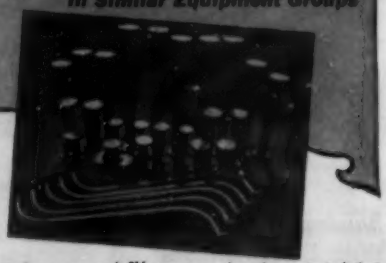

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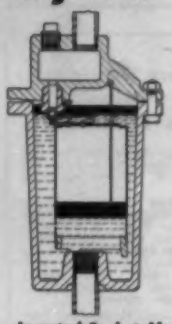

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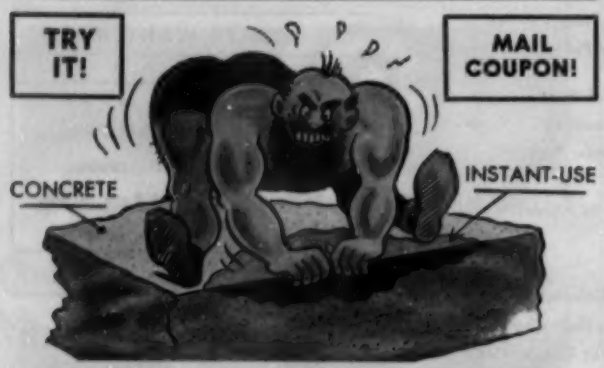


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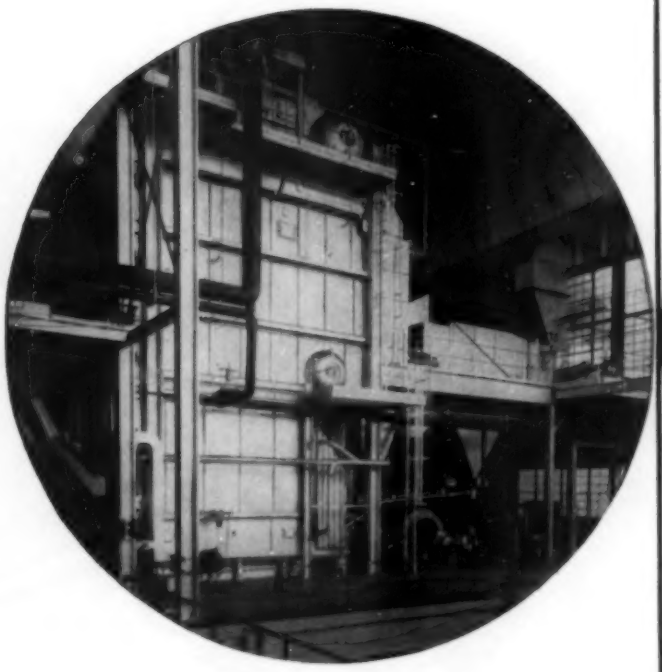

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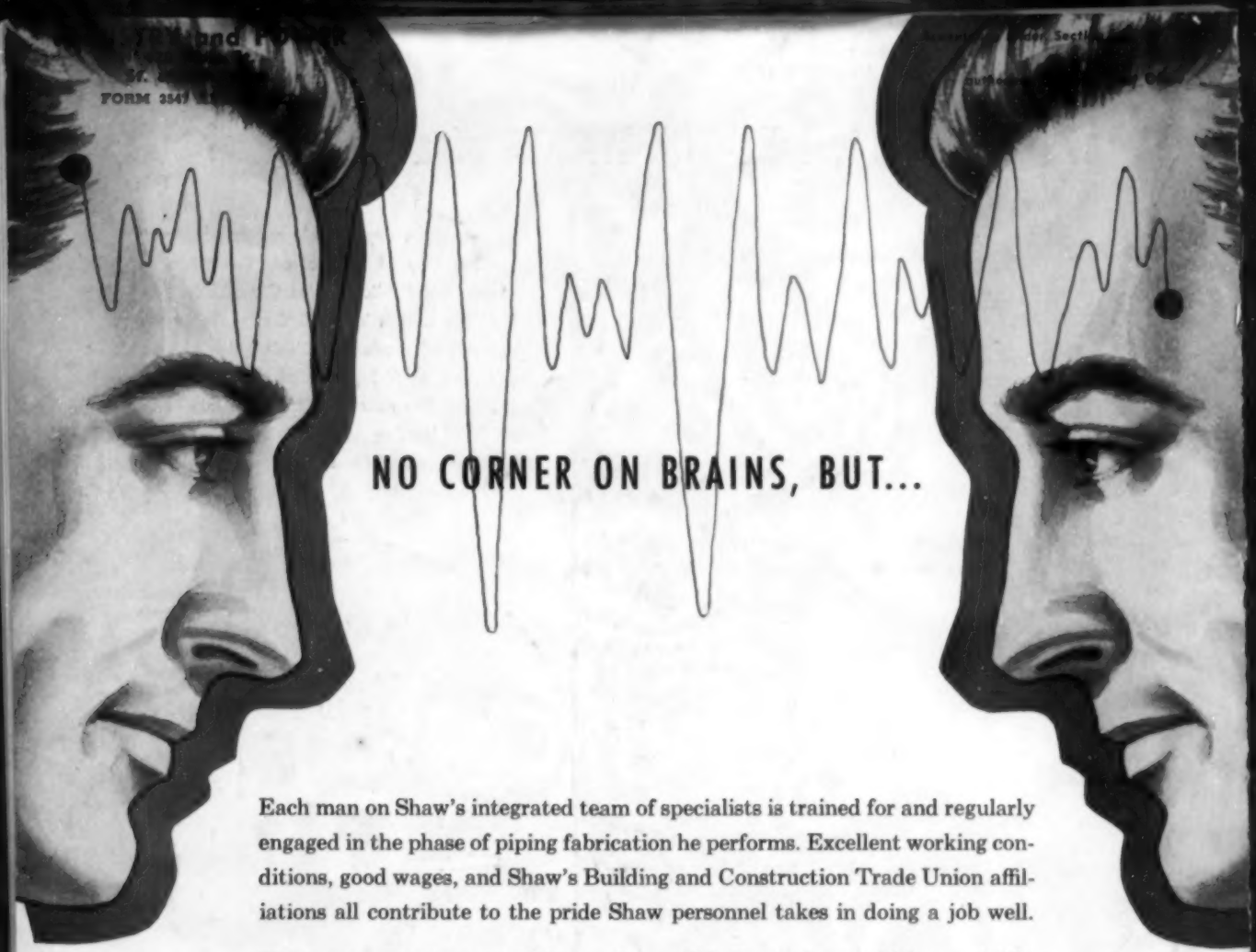

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